Proceedings

Forty-first Annual Western Forest Insect Work Conference

Coeur d'Alene, Idaho
March 6-8, 1990

PROCEEDINGS

FORTY-FIRST ANNUAL

WESTERN FOREST INSECT WORK CONFERENCE

COEUR D'ALENE, IDAHO

MARCH 5 - 8, 1990

Compiled by:

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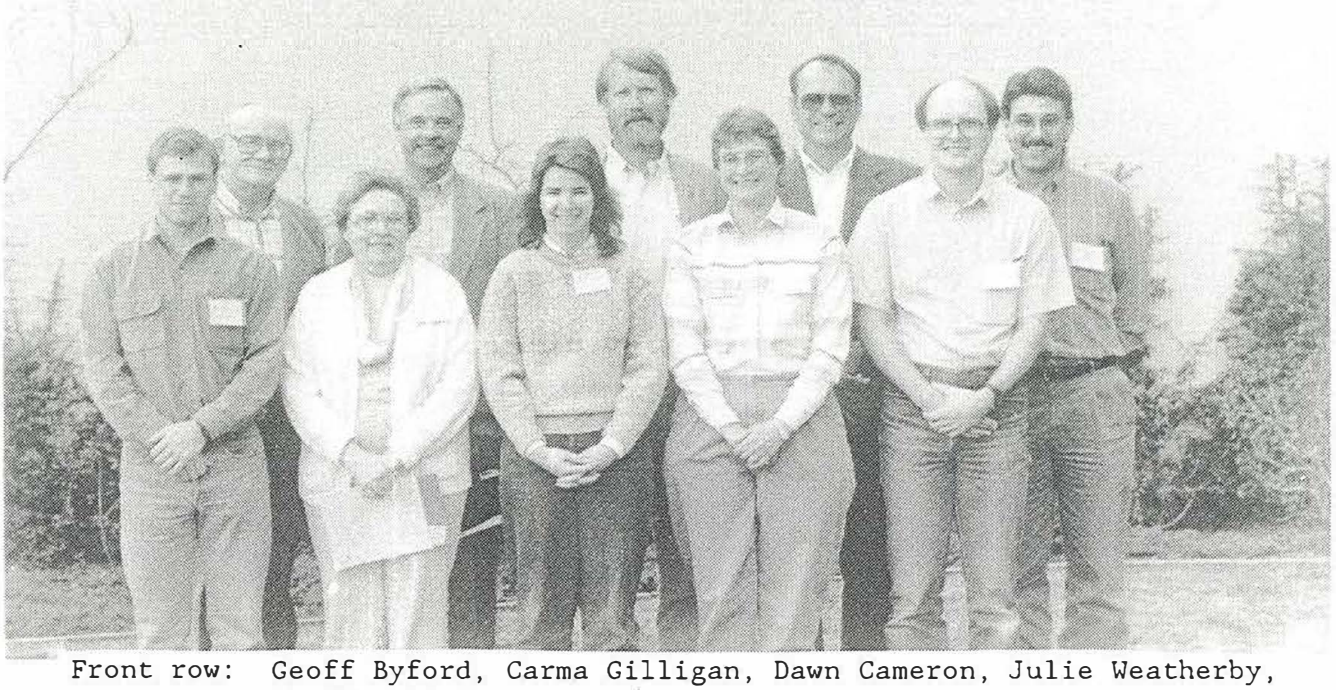
Printed on recycled paper

Front row: Jesse Logan, John Heasley, Don Scott, Shivanand Hiremath

Back row: Al Berryman, Mike Valenti, Andy Eglitis, Ladd Livingston

Front row: Mary Ellen Dix, Tom Koerber, Terry Rogers, Sandy Gast, Bernie Raimo

Back row: Mike Wagner, Russ Mitchell, Dan Forey, Mark McGregor, Bill Denton



Front row: Geoff Byford, Carma Gilligan, Dawn Cameron, Julie Weatherby, Staffan Lindgren

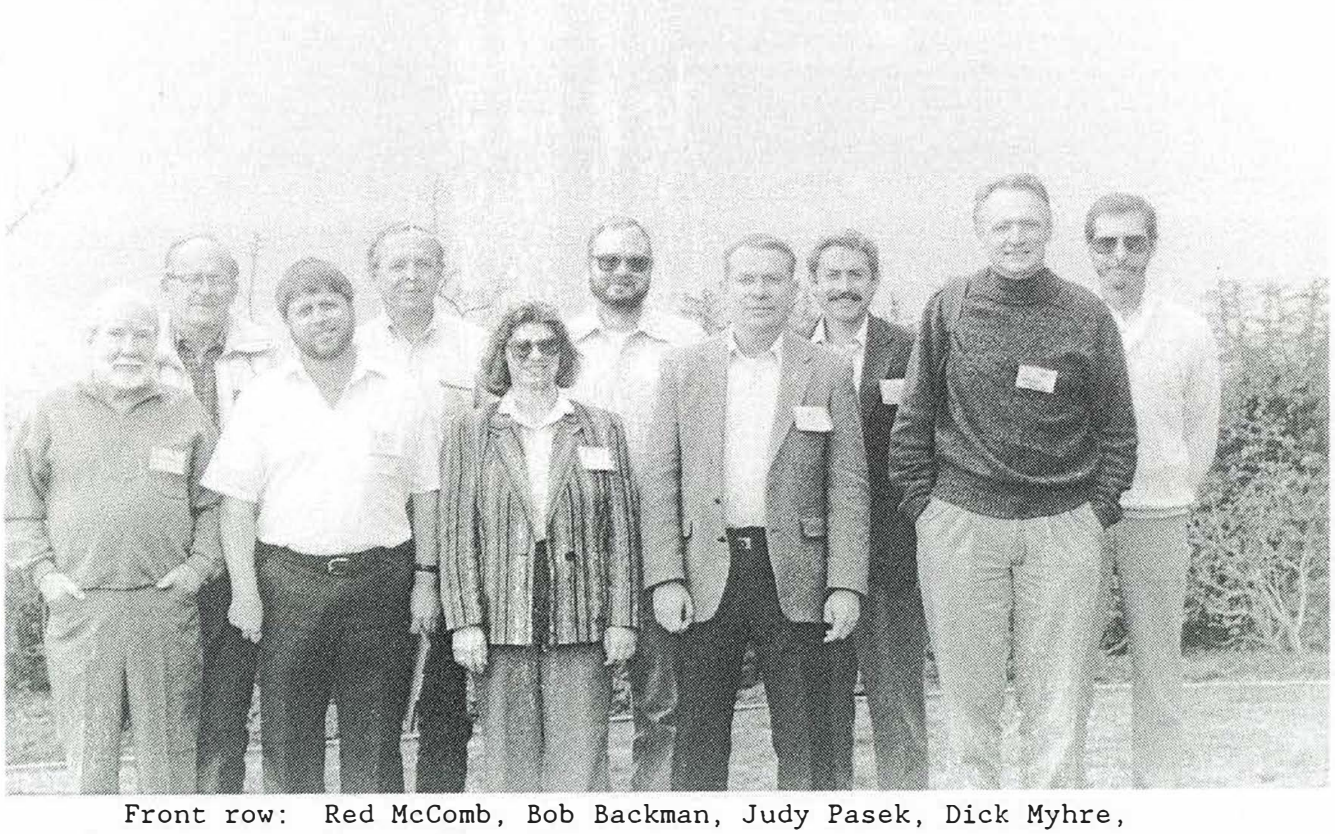
Back row: Ron Stark, Boyd Wickman, Tim Paine, Bill Ciesla, Marc Linit

Front row: Valerie Kalve, Phil Mocetteni, Larry Stipe, Wayne Bousfield, Andrew Taylor

Back row: Dennis Hart, Felton Hastings, Gene Amman, Kathy Sheehan, Mike Marsden

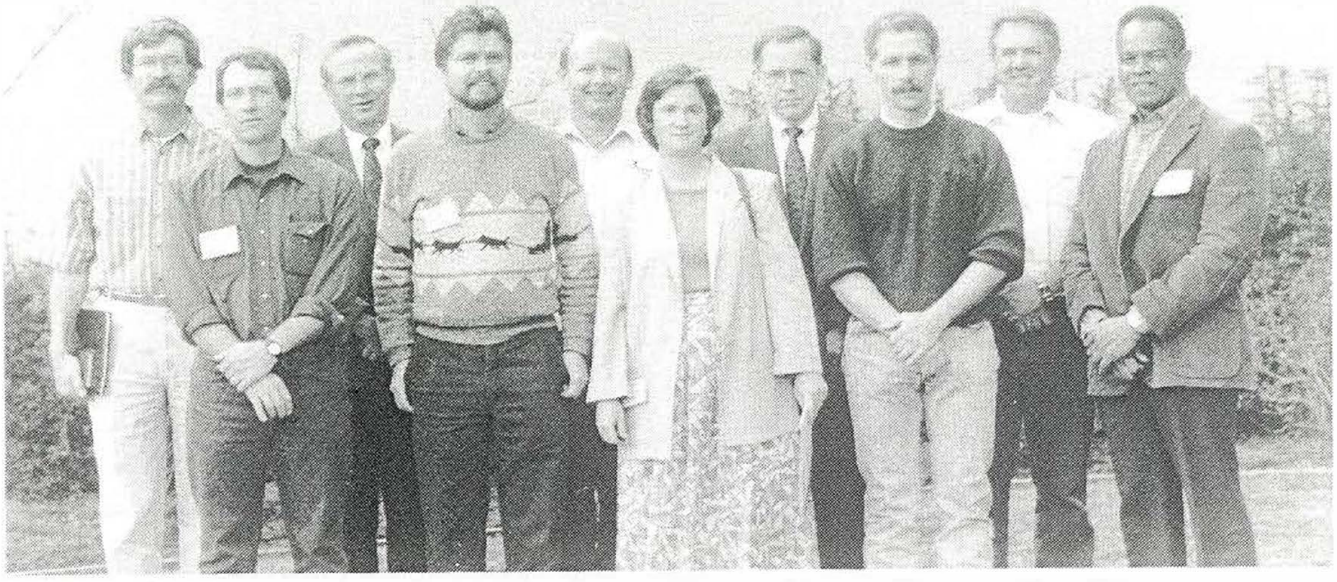
Front row: Ken Lister, Galen Trostle, Rob Carlin, Charles Sartwell, Jill Wilson

Back row: Peter Lorio, Jim Dunn, Syed Tanveer Haider, Dayle Bennett, John Wenz



Front row: Red McComb, Bob Backman, Judy Pasek, Dick Myhre, George Ferrell

Back row: Don Kinn, John Dale, Dave Schultz, Chuck Dull, Bob Eder

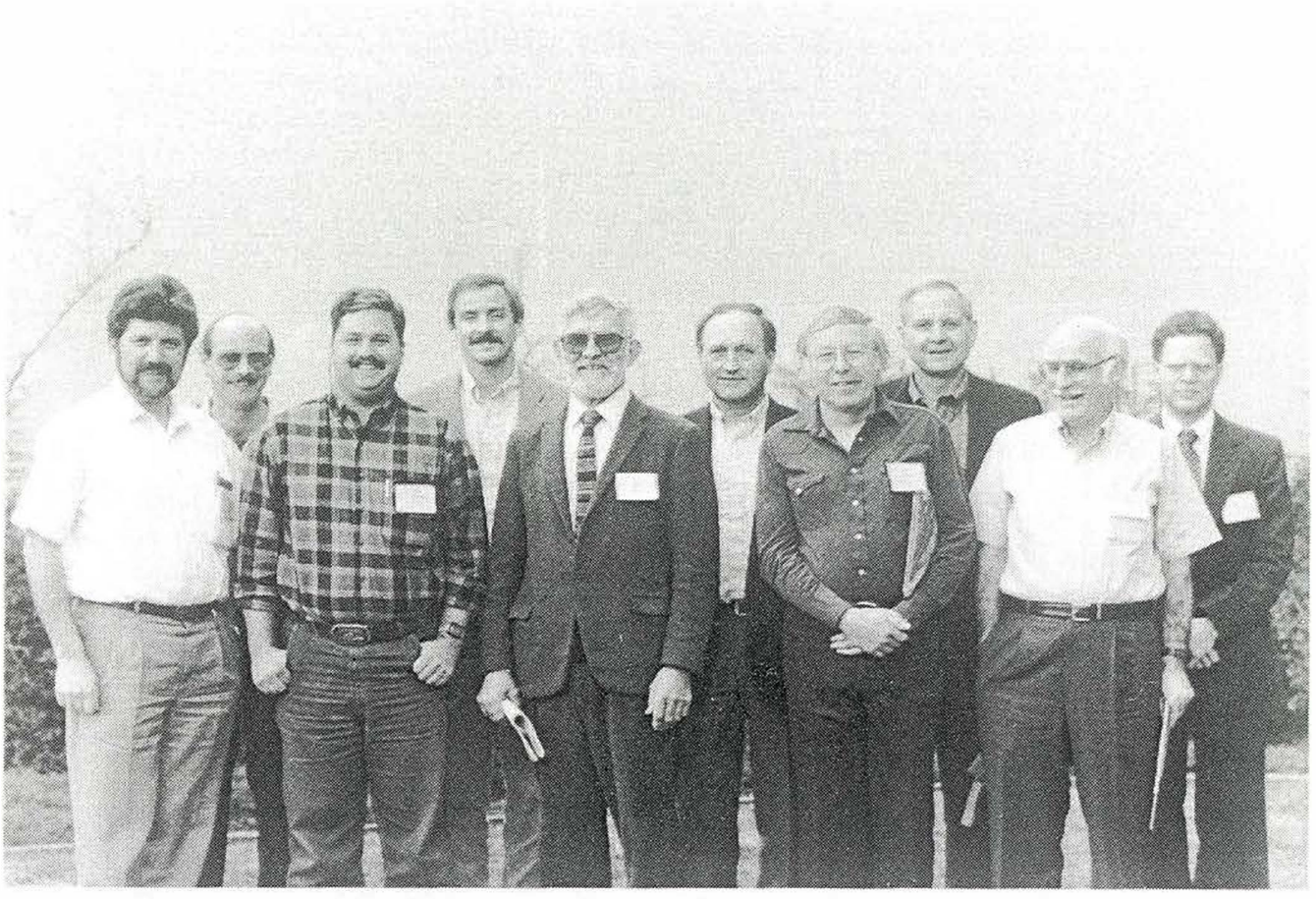


Front row: Joseph Liebl, Terry Shore, Karen Clancy, Ken Gibson, Carroll Williams

Back row: Ralph Thier, Jed Dewey, Tim McConnell, Bob Bridges, Lynn Wyatt

Front row: Nick Fielding, Lee Humble, Rich Goyer, Beth Willhite, Allen Robertson

Back row: Gary Petersen, Huber Meyer, Evan Nebeker, Karel Stoszek, Torolf Torgersen



Front row: John McLean, Brian Gardner, Mal Furniss, Bob Lavigne, Rick Johnsey

Back row: Peter Hall, Bill Thoeny, Herb Cerezke, Dick Schmitz, Bill Antrobius

PROCEEDINGS

FORTY-FIRST ANNUAL WESTERN FOREST INSECT WORK CONFERENCE

COUER D'ALENE, IDAHO

MARCH 5-8, 1990

Executive Committee (Forty-first WFIWC)

John M. Wenz	Chairperson
Richard F. Schmitz	Immediate Past Chairperson
R. Ladd Livingston	Treasurer & Local Arrangements
Katharine A. Sheehan	Secretary
Christine G. Niwa	Counsellor (1988-1990)
Timothy D. Paine	Counsellor (1989-1991)
Rene I. Alfaro	Counsellor (1990-1992)
Sandy Gast	Program - 1990
Ken Gibson	Program - 1990

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41st ANNUAL WFIWC
Coeur d'Alene, Idaho
March 6-8, 1990

FOREST ENTOMOLOGY: PAST, PRESENT AND FUTURE

Monday - March 5

3:00 - 7:00	Registration
7:00 - 9:00	Mixer
7:00 - 8:00	Executive Meeting

Tuesday - March 6

7:30 - 8:30	Registration
8:30 - 10:00	Initial Business Meeting
10:00 - 10:30	Break
10:30 - 12:00	Panel "Early History of Forest Entomology in the NW" - *Mal Furniss, U of I, Moscow, ID*
12:00 - 1:30	Lunch - Buffet (Provided)
1:30 - 3:00	Concurrent Workshops a. Status of Insect Models - *Bov Eav, MAG, Ft. Collins, CO* b. Pest Considerations in Uneven-Aged Management - *Boyd Wickman, PNW, LaGrande, OR* c. FPM Service Areas/Field Offices--Pros and Cons - *John Wenz, R-5, FPM, Sonora, CA* d. Insect Pheromones for Control - *Peter Hall, B.C. Forest Serv., Victoria, BC*
3:00 - 3:30	Break
3:30 - 5:00	Concurrent Workshops a. Identification, & Hopkins System - *Torolf Torgersen, PNW, LaGrande, OR* b. Silvicultural Control of Major Forest Pests - *Dayle Bennett, R-3, FPM, Albuquerque, NM* c. Pest Considerations in Tree Improvement Efforts - *Mary Ellen Dix, RM, Lincoln, NE* d. Making Forest Entomology More Visible - *Bill Ciesla, R-6, FPM, Portland, OR*
7:00 - 8:00	Forest Health Video "Are Our Forests Dying?"
8:00 - 9:00	Poster Session (History, Publications, Computer Models)

Wednesday - March 7

8:00 - 9:30	Panel "Gypsy Moth in the West" - *Ladd Livingston, IDL, Coeur d'Alene, ID*
9:30 - 10:00	Break
10:00 - 11:30	Concurrent Workshops a. Planning A Survey - *Mike Marsden, RM, Ft. Collins, CO* b. Predicting Pest Outbreaks: How Good Can We Get? - *Alan Berryman, WSU, Pullman, WA* c. Managing Insect Pests in Seed Orchards - *Julie Weatherby, R-4, FPM, Boise, ID* d. Coordination of Gypsy Moth Monitoring - *Bill Antrobius, R-1, TCFPM, Missoula, MT*
11:30 - 1:00	Lunch - Lake Cruise (Provided)
1:00 - 5:00	Field Trips a. Nursery - *Larry Stipe, R-1, TCFPM, Missoula, MT* b. Waferboard Plant - *Ken Gibson, R-1, TCFPM, Missoula, MT* c. "Hands On" Computer Demonstrations - *Sandy Gast, R-1, TCFPM, Coeur d'Alene, ID* d. Other
5:30 - 6:30	Fun Run
7:30 - 9:00	Walleyball Tournament

Thursday - March 8

6:30 - 7:30	Breakfast Buffet (Provided)
8:00 - 9:00	Panel "Advances in Forest Insect Research" - *John McLean, UBC, Vancouver, BC*
9:00 - 10:00	Final Business Meeting
10:00 - 10:30	Break
10:30 - 12:00	Concurrent Workshops a. "New" Forest Insects - *Allen Robertson, State of CA, San Ramon, CA* b. Use of Insects in Vegetation Management - *George Ferrell, PSW, Redding, CA* c. Insect Pheromones for Monitoring - *Charlie Sartwell, PNW, Corvallis, OR* d. Role of GIS in Pest Management - Ross Pywell, *MAG, Ft. Collins, CO*
12:00 - 1:00	Lunch
1:00 - 2:30	Concurrent Workshops a. Regeneration Insect Pests - *Mike Haverty, PSW, Berkeley, CA* b. Status and Role of Biotechnology - *Shivanand Hiremath, NE, Delaware, OH* c. Role of Parasites and Predators in Pest Mgt. - *Mitch Miller, SO, Pineville, LA* d. Role of Artificial Intelligence in Pest Management - *Molly Stock, U of I, Moscow, ID*
2:30	Adjourn

WESTERN FOREST INSECT WORK CONFERENCE

41ST ANNUAL MEETING
COEUR D'ALENE, IDAHO

EXECUTIVE COMMITTEE MEETING
MARCH 5, 1990

Present: John Wenz, Chairperson
Dick Schmitz, Immediate Past Chairperson
Ladd Livingston, Treasurer
Kathy Sheehan, Secretary
Tim Paine, Counsellor
Torgy Torgersen, Common Names Committee Chairman
Sandy Gast, Program Committee
Ken Gibson, Program Committee
Mary Ellen Dix, representative to the North American Forest Insect Work Conference, 1991

Chairperson Wenz called the meeting to order at 7:45 pm.

1) Minutes of the 1989 meetings

a) 1989 Executive Committee Meeting

Chairperson Wenz called for any changes or additions to the minutes; no such changes or additions were raised, and the minutes were approved.

b) 1989 Final Business Meeting

Two changes were noted: on page 17, Les McMullen's name was misspelled, and page 20, regarding the WFIWC Awards Committee: the award winner assumes the chair for the following year.

2) Treasurer's Report

Treasurer Ladd Livingston presented the following summary of the WFIWC's financial activities since he became treasurer.

April 1987	Initial deposit	$1,453.00
	expenses: 5.99	
	deposits: 42.86	1,489.87
Feb. 29, 1988	Rec'd from Park City 1987 mtg: 3,528.29	5,018.16
	expenses: 0.00	
	deposits: 115.84	5,134.00
Aug. 29, 1989	Rec'd from Flagstaff 1988 mtg: 1,400.00	6,534.00
	deposited $5,000 in timed deposit	
	checkbook balance	1,534.00
	expenses: 866.33	
	deposits: 480.50	1,148.17

Jan. 2, 1990	Rec'd from Bend 1989 mtg: 3,413.84			4,562.01
just prior to 1990 meeting	expenses: 3,588.49			
	deposits: 5,733.76		checking acct.	6,707.28
			timed deposit	5,137.22
		March 6, 1990 total on hand:		$11,844.50

Discussion: It was generally agreed that it is not appropriate for a non-profit group like ours to accumulate such a large balance. Several options were discussed, including:

* reducing or eliminating fees for students and retirees
* reducing or eliminating fees for all attendees
* establishing a scholarship
* providing rebates

These options will be presented at the initial business meeting for discussion, and additional ideas from attendees will be encouraged.

3) 1990 Meeting Information Update

A few program changes were reviewed by Ken Gibson and Sandy Gast, who will report these changes and meeting room assignments during the initial business meeting.

4) Future Meetings

a) March 1991 - Plans for a "National" Forest Insect Work Conference were reviewed by Mary Ellen Dix, who is serving as one of WFIWC's representatives on the committee that is organizing that meeting. The theme, objectives, and tentative agenda will be presented during the initial business meeting. The Executive Committee strongly recommended that Mary Ellen Dix seek to have the official name of this meeting changed to North American Forest Insect Work Conference to reflect the important role of Canadian and Mexican members in our work conference.

b) 1992 Meeting - We have received a renewed invitation from Don Dahlsten and Dave Wood of UC Berkeley to hold the 1992 meeting in California. It was noted that approximately 5 years have passed since the WFIWC last met in Canada, so that it may be appropriate to consider a Canadian venue for 1992. These two options for the 1992 meeting will be discussed at the initial business meeting.

5) Committee Reports/Actions

a) Founders Award Committee
Dick Schmitz reported that John Schmid has accepted the position of committee chair, and has organized a committee that includes LeRoy Kline (State Forest Entomologists), Mark McGregor (Private Industry), and John Neisess (Forest Pest Management). He is still seeking a university representative. This committee is

prepared to solict nominees for the award in 1990 and present the award at the North American Forest Insect Work Conference in 1991.

b) National Council of Forest Health Issues

John Wenz presented a letter from Dave Wood, one of our representatives to this group and the chair of the council. Dave proposed that because the NAS report is scheduled to be sent to Congress in late March, 1990, the council should meet in April to discuss the report, elect new officers, and prepare a report to member groups.

c) History Committee

No report was presented, though the prominent role of a panel ("The Early History of Forest Entomology in the NW") in this year's agenda was noted.

d) Common Names Committee

Torgy Torgersen reported the need for a new member on this committee to replace John Moser; our bylaws require seven members on this committee. Current members: Judith Pasek, Iral Ragenovich, Charles Sartwell, Robert Stevens, Larry Stipe, and chairman Torolf Torgersen.

Within the past calendar year, three names that we had submitted earlier were adopted by the Committee on Common Names of the Entomological Society of America:

western conifer-seed bug (Leptoglossus occidentalis)
ponderosa pine coneworm (Dioryctria auranticella)
western pine tip moth (Rhyacionia bushnelli)

A fourth name that we submitted, ponderosa pine tip moth for Rhyacionia zozana, has been published and, barring a successful protest, should be adopted sometime this calendar year.

e) Nominating Committee

Dick Schmitz is the Nominating Committee chairman. We have the following vacancies:

Chairperson
Counsellor (term to expire in 1993, replacing Chris Niwa)

6) Resolutions - None known at this time.

7) Other Business

a) Tributes

1) Deceased Members

Gerald N. Lanier, a longtime professor of forest entomology at Syracuse, has passed away. He earned his Ph.D. at U.C. Berkeley, and conducted research on Scolytus multistriatus among other topics.

2) New Members - will be recognized at the initial business meeting.

3) Awards - none known at this time.

b) Questionnaire

A questionnaire was distributed with the initial announcement for this work conference.

When asked how often we should hold joint meetings with the pathology work conference, there were 112 responses (approximately 25% of our membership). Five year intervals were selected by 72 respondents (64%). Other responses represented a wide range of opinions.

When asked whether the dates of our work conference should be changed, there were 100 responses. The traditional early March dates were preferred by 34 respondents, and 41 preferred September or October. Nearly two-thirds indicated a preference for a change from the early March dates, primarily to encourage field trips.

The Executive Committee agreed that these results should be presented to the membership for discussion. Regarding the question of work conference dates, it was moved by Torgy Torgersen and seconded by Ladd Livingston that: given that there is not compelling reason for a change in the dates that the WFIWC has been traditionally held, we should keep the early March meeting dates. The motion was approved unaminmously.

This meeting was adjourned at 9:00 pm.

WESTERN FOREST INSECT WORK CONFERENCE

41ST ANNUAL MEETING
COEUR D'ALENE, IDAHO

INITIAL BUSINSESS MEETING
MARCH 6, 1990

Chairperson Wenz called the meeting to order.

1) Introduction of new members

Clark Lovelady - Ph.D. student, Texas A & M University, College Station, TX
Dick Krebill - Assistant Station Director, Intermountain Research Station, Ogden, UT
Jim Dunn - post-doc, Southern Forest Exp. Station, Pineville, LA
Bill Antrobius - entomologist, Forest Pest Management, Missoula, MT

2) Tributes to members who have passed away

Gerald N. Lanier, a longtime professor of forest entomology at Syracuse, has passed away. Gerry earned his Ph.D. at U.C. Berkeley, and conducted research on Scolytus multistriatus among other topics.

3) Minutes of previous meetings

a) 1989 Final Business Meeting

Minutes of the Final Business Meeting held September 15, 1989 in Bend, Oregon were read and approved.

a) 1990 Executive Committee Meeting

A summary of the minutes of the Executive Committee meeting held Monday evening, March 5, 1990, were read and approved.

4) Treasurer's Report

Chairperson Wenz reported that he and Dick Schmitz had audited the treasurer's records and that they commended Ladd Livingston for the excellent job that he had done as treasurer.

Treasurer Ladd Livingston presented the following summary of the WFIWC's financial activities since he became treasurer.

April 1987	Initial deposit		$1,453.00
	expenses:	5.99	
	deposits:	42.86	1,489.87
Feb. 29, 1988	Rec'd from Park City 1987 mtg:	3,528.29	5,018.16
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Aug. 29, 1989	Rec'd from Flagstaff 1988 mtg: 1,400.00		6,534.00
	deposited $5,000 in timed deposit		
	checkbook balance		1,534.00
	expenses: 866.33		
	deposits: 480.50		1,148.17
Jan. 2, 1990	Rec'd from Bend 1989 mtg: 3,413.84		4,562.01
just prior to 1990 meeting	expenses: 3,588.49		
	deposits: 5,733.76	checking acct.	6,707.28
		timed deposit	5,137.22
		March 6, 1990 total on hand:	$11,844.50

Chairperson Wenz described several ideas brought up by the Executive Committee for dealing with the large balance that our work conference has accumulated. These ideas included:

* reducing or eliminating fees for students and retirees
* reducing or eliminating fees for all attendees
* establishing a scholarship
* providing rebates

He appointed Ladd Livingston to a committee to study this topic and asked for any members interested in serving on this committee to contact Ladd.

Discussion:

* several members supported eliminating fees for students and retirees
* also some support for reducing fees for all members
* several suggestions for encouraging students:
  - small grants to support student research
  - grants to cover travel expenses for students attending WFIWC
  - honorarium for some type of student award
* problems with any of these scholarship/educational support proposals:
  - these proposals would benefit only one person per year
  - our non-profit status may be at risk if we earn interest on a continuing basis (as would be needed to maintain a scholarship fund)
  - universities may start assuming that students can get funds from the work conference and therefore withdraw funds that would otherwise have been available to students
* some concern that the stated target balance of $2,500 is too low
* suggested that we use some of our surplus funds to support other groups, such as the North American Forest Insect Work Conference, or the National Council on Forest Health Issues.

5) Future Meetings

a) March 25-28, 1991 - Plans for a "National" Forest Insect Work Conference to be held in Denver, Colorado were reviewed by Mary Ellen Dix, who is one of WFIWC's representatives on the committee that is organizing that meeting. The theme, objectives, and tentative agenda were discussed, and are described in Appendix A. A flyer announcing the meeting will be mailed later this spring to the members of all work conferences involved; suggestions are welcome for other appropriate mailing lists as well as comments regarding the tentative program. The Executive Committee strongly recommended that Mary Ellen seek to have the official name of this meeting changed to North American Forest Insect Work Conference to reflect the important role of Canadian and Mexican members in our work conference.

b) 1992 Meeting - Don Dahlsten and Dave Wood of UC Berkeley have previously extended an invitation to hold the 1992 meeting in (or near) California. Terry Shore, on behalf of Forestry Canada and the BC Ministry of Forestry, invited the work conference to meet in Canada at a location to be decided. The Executive Committee will consider both invitations and make a recommendation at the Final Business Meeting.

6) Committee Reports/Actions

a) Nominating Committee

Dick Schmitz is the Nominating Committee Chairperson. We have the following vacancies:

Chairperson
Counsellor (term to expire in 1993, replacing Chris Niwa)

b) National Council of Forest Health Issues

John Wenz read a letter from Dave Wood, one of our representatives to this group and the chair of the council. Dave proposed that because the NAS report is scheduled to be sent to Congress in late March, 1990, the council should meet in April to discuss a response to the report, approve the bylaws and elect new officers, set the agenda for discussion of forest health issues, and communicate with member organizations.

c) Founders Award Committee

Dick Schmitz reported for committee chairperson John Schmid. Other committee members are: LeRoy Kline (State Forest Entomologists), Mark McGregor (Private Industry), and John Neisess (Forest Pest Management). He is still seeking a university representative. This committee plans to secure an appropriate plaque, issue a call for nominations, and evaluate candidates. If consensus is reached, the first award will be presented at the North American Forest Insect Work Conference in 1991.

d) Common Names Committee

Committee chairperson Torgy Torgersen reported that:

1) John Moser, our representative from the Southern Forest Insect Work Conference, has stepped down. This committee is seeking a new member; the bylaws require seven members on this committee.

2) Within the past calendar year, three names that had been submitted earlier were adopted by the Committee on Common Names of the Entomological Society of America:

western conifer-seed bug (Leptoglossus occidentalis)
ponderosa pine coneworm (Dioryctria auranticella)
western pine tip moth (Rhyacionia bushnelli)

3) A fourth name that had been submitted, ponderosa pine tip moth for Rhyacionia zozana, has been published and, barring a successful protest, should be adopted sometime this calendar year.

e) History Committee (report submitted after the meeting)

The 41st annual meeting of the WFIWC featured the plenary session "Early History of Foest Entomology in the Northwest" organized and moderated by Malcolm M. Furniss. Presentations included: "A.D. Hopkins" by Mal Furniss, "The Ashland, Oregon Laboratory" by Boyd Wickman, "Forest Entomology in Western Canada to 1948" by Ron Stark, and "The Couer d'Alene Laboratory" by Galen Trostle.

A display of historical photographs of personnel and activities of the western U.S. Bureau of Entomology Laboratories was prepared. Following the meeting, these will be placed in the WFIWC Archives at the University of Idaho. Photo contributors were: Doris Bugbee Bourgeois, John Craighead, Jean Craighead George, D.G. Fellin, M.M. Furniss, R.L. Lyon, Colonel Barry P. Rust, J.M. Schmid, R.H. Smith, and B.E. Wickman.

During the year, the following contacts were made by M. Furniss in search of historical material: Col. B.P. Rust, grandson of H.J. Rust; J. Craighead and Jean Craighead George, children of F.C. Craighead; Edna Terrell, wife of Tom Terrell; and Frances Furniss, wife of R.L. Furniss.

Various materials were gathered from several sources for transmission to the archives. A manuscript on A.D. Hopkins in relation to his life in West Virginia was obtained from Wayne Berisford, University of Georgia. Several unpublished photos of Hopkins were ordered from the West Virginia Collection, West Virginia University. Work on purging and collating the personal papers of R.W. Stark for submission is almost completed.

Transcripts of oral history interviews of Robert L. Furniss and James C. Evenden were edited by M.M. Furniss. That of RLF was

enhanced by the addition of his bibliography, pertinent references, and photos of him throughout his life.

The committee met at the Couer d'Alene Resort on Tuesday, March 6, 1990 at 3:00 pm. Present were M. Furniss and R. Stark, co-chairmen, B. Wickman, and G. Trostle. Recommendations emanating from this meeting were:

1. All future WFIWC meetings should include a workshop on forest entomology history.
2. Work should proceed on the following projects:
   a. Bureau of Entomology historical photo files at Berkeley, LaGrande (Portland), Missoula (Couer d'Alene), and Fort Collins.
3. Publish the H.E. Burke report, "My recollections of the first years of forest entomology".

7) Other Business

John Wenz reported the results of a questionnaire that had been included in the initial announcement for this meeting.

When asked how often we should hold joint meetings with the pathology work conference, there were 112 responses (approximately 25% of our membership). Five year intervals were selected by 72 respondents (64%). Other responses represented a wide range of opinions. The Executive Committee recommended that the new chairperson write a letter to the chairperson of the pathology work conference summarizing these results and asking for a response.

When asked whether the dates of our work conference should be changed, there were 100 responses. The traditional early March dates were preferred by 34 respondents, and 41 preferred September or October. Nearly two-thirds indicated a preference for a change from the early March dates, primarily to encourage field trips.

The ensuing discussion focused on late summer or early fall as the primary alternative time of year for the WFIWC. Conflicts with the traditional dates of other meetings and the field season were noted. A consensus was reached that no action is required at this time; the WFIWC should continue to be held in early March.

8. Resolutions

John McLean noted that the book, Western Forest Insects by Furniss and Carolin, is out of print, and wanted to know how much interest and support exists among work conference members for a reprinting of this book. Several supportive comments were made, and John was encouraged to present a resolution at the final business meeting for a reprinting of this book.

There being no other new business, Chairperson Wenz adjourned the meeting.

WESTERN FOREST INSECT WORK CONFERENCE

41ST ANNUAL MEETING
COEUR D'ALENE, IDAHO

FINAL BUSINSESS MEETING
MARCH 8, 1990

Chairperson Wenz called the meeting to order.

1) Minutes of the Initial Business Meeting

The minutes were read and approved.

2) Resolutions

a) John McLean presented the following resolution:

Be it resolved that the Western Forest Insect Work Conference recommend to the Directors of Forest Pest Management and Forest Insect and Disease Research, USDA Forest Service, Washington DC, that the USDA Miscellaneous Publication No. 1339, Western Forest Insects, by R.L. Furniss and V.M. Carolin be reprinted for the benefit of students and practicing forest pest managers in North America.

Moved and seconded; the vote was unanimous in favor of the resolution.

b) Torgy Torgersen presented the following resolution:

Be it resolved that the membership recognizes and thanks the organizers of the 41st Annual Meeting of the Western Forest Insect Work Conference. They have given their time and skills to provide for us another quality meeting.

In particular, for organizing workshops, we thank Ken Gibson, Sandy Gast, Jed Dewey, and Bill Antrobius.

For accomodations and arrangements - Ladd Livingston and David Beckman.

For registration - Carma Gilligan and Faith Bergam.

And, for organizing the walleyball tournament and fun run, Julie Weatherby and Ken Gibson.

We extend our special thanks to workshop moderators for their efforts in putting together thses productive and informative sessions. The longtime members also want to thank and encourage our young, new professionals and first-time attendees for their interest in this meeting.

Moved and seconded; the vote was unanimous in favor of the resolution.

3) Committee Reports

a) Nominations Committee, chaired by Dick Schmitz

The following nominations were proposed:

WFIWC Chairperson (2 year term): Terry Shore

WFIWC Counsellor (3 year term to 1993): Bernie Raimo

WFIWC Common Names Committee (indefite term): Lee Humble

Moved and seconded as read; the vote was unanimous in favor of the nominations.

4) Future Meetings

The membership accepted the Executive Committee recommendation that the 1992 work conference be held in Canada (accepting the invitation of Terry Shore), and that the 1993 work conference be held in or near California (accepting the invitation of Don Dahlsten and Dave Wood).

5) Other Business

Ken Gibson reported that 9 members participated in the fun run, which was won by Joe Fox.

Julie Weatherby described the results of the walleyball tournament, which attracted 32 participants and 10-15 fans. The first place team was Big Russet and the Spuds, consisting of Marc Linit, Barb Bentz, Bill Ravelin, and Lucas Schuab. Second place went to the Palouse Geriatrics, featuring Alan Berryman, Gary Long, Felton Hastings, and Mark Valenti.

On behalf of the membership, Steve Burke thanked John Wenz for his excellent work as chairperson of the work conference for the past two years. Following a big round of applause, John turned the gavel over to incoming chairperson Terry Shore.

Chairperson Shore adjourned the meeting.

Chairperson's Address

41st Annual Meeting of the
Western Forest Insect Work Conference

March 6, 1990
Coeur d'Alene, ID

Good morning and welcome to the 41st annual meeting of the Western Forest Insect Work Conference. It is gratifying to see that so many have been able to attend this conference despite it being held just six months after the joint meeting with the Pathologists in Oregon last September. Although the Bend meeting was, by most accounts, very successful, returning to a more manageable number of participants here in Coeur d'Alene should provide plenty of opportunity for formal and informal discussion and interaction during the workshops and other activities planned by the Program Committee.

The theme of this years Conference, "Forest Entomology: Past, Present and Future", doesn't seem particularly restrictive. I'm going to confine my remarks to two general areas relating to the "future" of forest pest management. These comments may primarily reflect a Forest Service perspective, but certainly have implications for forest pest management in general. These two topics are (1) a changing management emphasis for the National Forests and (2) a "reorientation" of research programs in the Forest Service.

There is currently underway in the Forest Service a change in forest resource management emphasis from one perceived by a majority of the publics to favor commodity resource production, to a more ecologically sensitive way of managing the National Forests. This change in management emphasis is commonly referred to as "New Perspectives in Forestry" and basically seeks to develop and implement alternative land management strategies that provide an acceptable mix of commodity production, amenity use, protection of environmental and ecological values, and biological diversity. The intent is to provide management of forest resources that is not only responsive to the scientific and economic aspects of forestry, but is also responsive to the social, environmental and political issues related to forestry. What this means exactly is not entirely clear at this point, but will likely involve some changes that have implications for forest pest management and how we view the role of insects and diseases in forest ecosystems.

The increased emphasis on resources other than timber production will obviously increase the need for insect and disease mangement in areas with resource management objectives oriented toward, for example, developed recreation, threatened and endangered species, and wildlife habitat management. There has already been considerable pest management input to developed recreation and special use areas and demand will likely increase, particularly as use increases and as more vegetation management plans are prepared and implemented for recreation sites. In addition, as habitat requirements for wildlife, such as the northern spotted owl, become better understood, there will be an increased need to evaluate the role of insects and diseases in these habitats and provide

management alternatives as needed. Preventive strategies and integration of insect and disease considerations into silvicultural prescriptions for such areas will be critical to these efforts.

The implications of implementing this more balanced resource management strategy include a possible reduction in the Allowable Sale Quantity (10%-20%), reduced forest land available primarily for timber production, a reduced emphasis on clearcutting, and a concomitant increase in interest in unevenaged management. This is already being reflected to an extent in current Land and Resource Management Plans. For example, the Regional Forester in California has stated that the annual timber sale volume in R5 is likely to decrease from the 1.8 billion bd-ft sold in the last decade to about 1.4 to 1.6 billion bd-ft. In addition, he stated that "while clearcutting will remain an essential harvesting technique in some areas and for particular species of trees, I plan to use methods other than clearcutting on approximately 70% of areas harvested, dependent on adequate funding.".

The potential consequences of this to pest management include the impacts of more frequent stand entries, influences on stand conditions that affect defoliator activity, and effects on our ability to manage root diseases and dwarf mistletoes that can not only be pests in their own right, but also tend to predispose trees to successfull bark beetle attack. There will be ample opportunity to discuss these and other potential consequences in the "Pest Considerations in Uneven-Aged Management" and "Silvicultural Control of Major Forest Insects", workshops scheduled for this afternoon. To the extent that the acreage dedicated to timber production does decrease, insect and disease impacts in these areas, and hence, their prevention and management, will likely become more important.

As part of this changing resource management emphasis, research is initiating a program to develop, evaluate, and demonstrate new techniques in forest management. The goal of this program is to 1) manage forests to balance values and produce a sustained supply of goods and services and 2) maintain biological diversity. One aspect of this is sometimes referred to as "landscape-level" management oriented toward watershed, drainage or larger area-scale management. As this effort unfolds, it should provide added challenges for entomologists and pathologists to focus not only on pest impacts, but also to try and elucidate the beneficial roles insects and diseases play in long term site productivity.

The second topic stems simply from some uncertainty as to what the emphasis is, or will be, on forest insect and disease research given the recently proposed Forest Service "priority research programs" that reflect a reorientation toward "critical natural resource issues facing the Nation and world today". The six priority program areas are: 1) Global climate change; 2) Water quality: the cumulative effects of management; 3) Threatened and endangered species; 4) Enhancing forest-based economics in rural America; 5) Southern forest productivity; and 6) Catastrophic forest fires. It is not entirely clear where forest insect and disease research fits into these emphasis areas; it would be certainly be undesirable if funding priorities changed to the detriment insect and disease research.

Concern over Forest Health, concern over research and education in forestry and natural resources, and concern over forest insect and disease research in particular, prompted the formation of the ad-hoc National Council on Forest Health Issues intended to provide a forum to address such issues. The boundaries between applied insect and disease research and the application or extension end of the continuum are often rather fuzzy and ill-defined. With this proposed "reorientation" of Forest Research programs, it may be an opportune time, and there may be considerable merit in, seriously looking at ways to more closely integrate applied insect and disease research and Forest Pest Management.

John M. Wenz
Chairperson

PANEL: EARLY HISTORY OF FOREST ENTOMOLOGY IN THE NORTHWEST

Moderator: Malcolm Furniss

Panelists: Boyd Wickman, Ronald Stark, Galen Trostle

A display of historical photos provided a backdrop for the session. Persons contributing photos and other material were: Col. Barry Rust, grandson of Henry J. Rust (employed at Coeur d'Alene Lab, 1921-1943), Boyd Wickman, Dave Fellin, John Schmid, Dick Smith, Bob Lyon and M. Furniss.

ANECDOTAL BIOGRAPHY OF ANDREW DELMAR HOPKINS (1857-1948)--Mal Furniss

Hopkins was a West Virginian, educated in the county schools. At age 17, he took over his grandfather's farm (later referred to as Kanawha Station, where he went for vacations and studied bioclimatics). Details of the following 16 years are sketchy, but he was progressive, having introduced improved breeds of farm animals and crops, including a variety of timothy that he selected from his meadow. He also started one of the first cooperatives, called the Farmers' Institute Society.

In 1889, at age 32, he heard that W. Va. Univ. Agric. Expt. Sta. was seeking a state entomologist, financed by the Hatch Act of 1888. Director John Meyers rebuffed Hopkins' application, but the latter responded strongly by letter, enclosing drawings and biological data that he had acquired on the raspberry borer, *Agrilus ruficollis* L. and stating that he would work for $1.00/day if allowed to stay on the farm.[1/] On Dec. 28, 1889, Meyers advised Hopkins that he would be hired March 1, 1890, for $50/mo. on trial. (Later, he learned that the other applicant wanted $2000/yr and a secretary).

In his new position he set about interviewing West Virginia farmers. Asked "What insects cause you the most problems?", a typical response, in Hopkins own words, was something like, "I reckon it's them hen hawks." By resorting to "bugs," he got the desired answers.

In August, he traveled with botanist C. F. Millspaugh to the mountains. On Old White Top they discovered a vast forest of spruce and pine killed by the southern pine beetle. Thus began Hopkins' involvement with forest entomology. He subsequently corresponded with Oberfoerster W. Eichhoff of Strasburg, Germany, for candidate natural enemies to control the beetles. A clerid, *Thanasinius formicarius* L., was chosen and Hopkins went to Europe in 1892 to collect them, financed by $900, of which $750 was contributed by West Virginia timber companies. After his arrival, an outbreak of the plague occurred in Europe and he went to Switzerland where he waited until receiving some assurance that his baggage (and clerids) would not be fumigated upon arrival in New York.

In spring 1893 the clerids were released at 26 locations. His timing was remarkable; the outbreak had collapsed over winter. This fortuitous event must not have hurt Hopkins' reputation! However, he

recounts (Insect Life 6:128 (1893)) that the black turpentine beetle flew "like a hailstorm" and "during my absence from the Morgantown station, one of these migrating swarms of Scolytids invaded the town and occurred at certain houses and at furniture factories in such immense numbers that some of the people became alarmed. The report was started that Hopkins' German bugs had devoured all the pine bugs and were going to prove like the English sparrow, a universal pest. It was probably well for me that I was absent at the time."

Largely due to Hopkins' efforts to import the clerid, he was awarded an honorary Ph.D. degree by West Va. Univ. in 1893. He never claimed that the clerid had become established, however.

In the last decade of the 1800s, events in American forestry were taking shape that were to broaden Hopkins' work beyond West Virginia and lead to his appointment in 1902 as head of the newly created Division of Forest Insect Investigations in the USDA, Bur. of Entomology. The person most responsible for those developments was Gifford Pinchot[2/], head of the Bureau of Forestry, who appointed Hopkins as a collaborator to travel to the Pacific Northwest in 1899 to investigate forest insect problems. In three months he visited Calif., Ore., Wash. and Idaho, uncovering and correctly interpreting nearly all of the important insect problems. He collected 4,363 specimens and made 760 notes.

At Washington State College he met entomologist C. V. Piper who thereafter urged one of his students, Jesse L. Webb (B.S. 1900), to major in forest entomology. Webb was hired by Hopkins in 1902. His second employee was Harry E. Burke, (WSC, B.S. 1902)[3/].

A further treatment of Hopkins' work and the influence he had on others and on development of forest entomology is beyond space here. However, he originated the idea of specialization in insect groups and a long list of famous taxonomists began their careers under him: Snodgrass, Rowher, Craighead, Snyder, St. George, Greene, Boving, etc.

His revision of the genus *Dendroctonus* (1909) is a classic. His prolific earlier writings contained many interesting details that would not survive today's publication process with its rigid style and economies. Those interested might start with his W. Va. A.E.S. Bull. 56 (1899) regarding the outbreak mentioned earlier. His early publications with USDA, Bur. Ent. are likewise interesting reading, for example, U.S.D.A. Div. Ent. Bull. 32 (1902) tells of his trip to the Black Hills Forest Reserve, Sept. 1-4, 1901, accompanied by Gifford Pinchot, during which *D. monticolae* was discovered and subsequently described.

Hopkins was chief of USDA, Forest Insect Investigations until July 1, 1923, when he relinquished the job to F. C. Craighead, Sr., and continued work on bioclimatics at Kanawha Station, W. Va., whence he became state entomologist 33 years prior. He died in Parkersburg, September 22, 1948.

1/ Personal communication from C. Wayne Berisford, U. Georgia, Jan. 19, 1990.

2/ For a very entertaining story, see Breaking New Ground by G. Pinchot (1948).

3/ Burke wrote an important, unpublished, report: "My Recollections of the First Years in Forest Entomology." Berkeley, Calif., June 28, 1946.

ASHLAND, OREGON FIELD STATION, 1912-1925. Boyd E. Wickman

Entomologists were the earliest specialists to work in the forests of the Pacific Northwest: most notably, Dr. Andrew Delmar Hopkins, whose collecting trip to the Northwest in 1899 led to the organization of the Office of Forest Insect Investigations in the Division of Entomology, U.S. Department of Agriculture, in 1902.

Reports of insect damage to large areas of Douglas fir and hemlock on the Oregon coast resulted in a trip to the region in 1899 by Hopkins, who was then stationed at the West Virginia Agricultural Experiment Station. He traveled under a temporary assignment from the U.S. Department of Agriculture. Hopkins visited Clatsop and Tillamook counties in early May and found extensive areas of dead forest, but he did not find the caterpillars that were reported to have done damage in the early 1890s.

During this trip west, Hopkins made a quick survey of forest insect problems in California, Oregon, Washington, and Idaho. His report on the magnitude of these problems in the western United States led eventually to the establishment of the Office of Forest Insect Investigations, and Hopkins was appointed the first chief of the new organization on July 1, 1902.

In November 1902 Harry Eugene Burke, a recent graduate of Washington State Agricultural College, was appointed to the U.S. Department of Agriculture's Bureau of Forestry and was assigned to assist Hopkins. In 1903 Dr. Hopkins divided responsibility for field investigations of forest insects in the United States into four major areas--Eastern, Southern, Rocky Mountain, and Pacific Coast--and assigned an entomologist to each. Burke was the specialist chosen for the Pacific Coast area, which included the states of California, Oregon, and Washington.

Burke's first major assignment in 1910-11 was as entomologist-in-charge of the first bark beetle control project in the west, at Baker City, Oregon, jointly financed by a $25,000 appropriation from Congress and money from private landowners.

At the conclusion of the project Burke moved to another bark beetle project at Yreka, California, for the next two years.

In 1913 headquarters for the "Pacific Slope Station" was established at Ashland, Oregon, with John Miller in charge. Burke was in overall charge but lived and worked from Placerville, California.

The laboratory was housed in three different locations at Ashland until 1924. It was the training ground for such notable forest entomologists as F.P. Keen, J.M. Miller, and John Patterson. Some of the earliest western research on bark beetles and cone and seed insects was carried out from this station.

In 1920 Miller transferred to North Fork, California, and was placed in charge of all bark beetle research on the west coast. By late 1924 the headquarters for the Pacific Slope Station was located on campus at Stanford University.

Early the next year the Ashland Station was closed and Patterson moved to Stanford, California.

The story concludes at this point. Slides were shown of early transportation, field stations, project camps, and personnel.

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Keen, F. P. 1958. Cone and seed insects of western forest trees. USDA Tech. Bul. No. 1169.

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FOREST ENTOMOLOGY IN WESTERN CANADA--THE FORMATIVE YEARS. Ron Stark

The early influences on forest entomology prior to the establishment of a Dominion Entomologist in 1883 are discussed. The subsequent development of western forest entomology to the end of WW-II is presented in four sections, survey, research, control and education.

The Forest Insect Survey began as a volunteer "Insect Intelligence Service" in the 1800s. It was 'federalized' by J. M. Swaine in 1931, enlarged and renamed by J. J. Degryse in 1936-37. Early western surveys were conducted by J. M. Swaine and H. A. Richmond. Survey units were established in Vernon, B.C. (1937), Winnipeg, Manitoba (1938), Indian Head, Saskatchewan, (1940), Calgary, Alberta (1948), and Victoria, B.C. (1949).

Research on natural controls of defoliators was done by A. B. Baird from 1918-21 at Agassiz, B.C. The Province established a laboratory in Vernon in 1919, Ralph Hopping as director. It became a federal lab in 1922-23. Other western labs were Indian Head (1928), Vancouver (1928-1940), Winnipeg (1937), Victoria (1940) and Calgary (1948-1960).

Bark beetle control dominated western forest entomology in the early years. Mechanical control of tussock moth using steam hoses was tried in Vernon in about 1912. Prior to 1948 there were only six attempts to control defoliators. The first aerial spray was in 1929. DDT was first used in 1946.

Education was slow to respond to the need. General entomology was taught from 1919 at the University of British Columbia but the first position in forest entomology was not until 1948. Dr. Kenneth Graham was the first official professor. George Hopping and Ray Lejeune both 'volunteer' courses at UBC and U. Winnipeg, respectively, during their tenures.

Prominent forest entomologists during this period, in approximate order of appearance, included: J. M. Swaine (1911), Ralph Hopping (1919), H. A. Richmond (1919), George Hopping (1921), Bill Mathers (1921), Ken Graham (1934), J. J. DeGryse (1936), Ray Lejeune (1937), M. L. Prebble (1940).

COEUR d'ALENE, IDAHO FIELD STATION -- 1915-1955. Galen Trostle

The history of the station mirrors the professional life of James C. Evenden (1889 - 1980), who was hired by A. D. Hopkins in October, 1914. After a winter spent camped out in Montana, Evenden moved to Coeur D'Alene in March 1915 where he remained until retiring in 1954.

His first office and living quarters were in a room rented in a private home. After returning from overseas as an infantry captain in June 1918, the office was located in a house at 7th and Front St., rented for $10 per month until February 1923. When the station closed in 1955, it was located in the Federal building.

His assignment was to determine the status of forest insects in the region, define the seasonal history of bark beetles and obtain phenological records for Hopkins' use in formulating his "bioclimatic law".

Through the years, various persons were employed at the station. First was Henry J. Rust (July 1920), then Archie L. Gibson and Tom T. Terrell (July 1, 1929), all of whom spent their entire careers there. Gibson and Terrell were Senior Scientific Aids (not college-trained). Rust was an accomplished photographer and was an exacting worker who did all of the insect rearing and associated record-keeping. Terrell supervised many control projects, developed and patented a spray nozzle for treating bark-beetle infested trees and adapted Weather Bureau kites for sampling flying bark beetles.

Much of the work at the station involved the mountain pine beetle, spruce beetle, Douglas-fir beetle, pine engraver, spruce budworm, Douglas-fir tussock moth, pine butterfly and larch casebearer (found in the west at St. Maries, Idaho, in 1957). Numerous methods of survey and control were tried and developed. Included were burning, peeling, trap

trees, treating beetle infested trees with toxic sprays and injection of chemicals; and ground and aerial spraying of defoliators. The first spray project against spruce budworm in the west was in Cody Canyon, Wyoming, ca. 1930, using lead arsenate. The first western aerial spray project was the use of DDT to control Douglas-fir tussock moth in northern Idaho in 1947.

Other prominent persons employed prior to WWII were D. DeLeon, W. D. Bedard, Sr., Lynn Baumhofer, Bill Wilford, Reginald Balch, R. L. Furniss (summer 1929) and Roy Nagel. Later personnel included Philip C. Johnson, Galen C. Trostle, Robert E. Denton, David McComb and David G. Fellin.

References:

Biography of James Crawford Evenden (1889-1980). (Oral History Interview by R. C. Larson, Forest Histories Soc., at Coeur d'Alene, March 23, 1979, edited by M. Furniss Nov. 1989, 26 p.).

"Forest Insect Laboratory, Coeur d'Alene, Idaho." (Luncheon address by J. C. Evenden at 20th WFIWC, Coeur d'Alene, March 10-13, 1969).

PANEL: GYPSY MOTH IN THE WEST
Moderator: Ladd Livingston
Panelists: Alan Mudge, Jeff Miller, Ron Stark, Robert Dowell

Gypsy Moth Programs In The Western United States - An Overview

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The gypsy moth has frequently been found in the western United States as an unwelcomed visitor from the east. However, unlike the northeast, we have the ability to detect, delimit and eradicate isolated infestations of this pest. Consequently, gypsy moth programs in the west have consisted of: survey programs to detect isolated infestations; delimitation of infestations through intensive trapping and egg mass surveys; use of various control methods in eradication programs; posttreatment surveys; quarantines to limit the spread of the gypsy moth; monitoring "move-ins" from generally infested areas; and public information programs. The extent to which any state has done or continues to do all of the above varies greatly, however, all western states have so far maintained a policy of eradication, should an isolated infestation of the gypsy moth be detected.

The more effective positive enantiomer of the female sex pheromone is a highly effective survey tool for western states to use to detect male gypsy moths. Survey and detection trapping, utilizes trap densities of 1-4 traps/mi^2 in high risk areas with suitable habitat. Following an initial detection, delimitation trapping (using densities of 16 to 49 traps/mi^2 in a grid pattern) is implemented to determine if the detection(s) represent an actual infestation and to delimit the infested area for subsequent treatment. Mass trapping utilizes the trap itself as a control tool when placed in densities of 3 to 9 traps/acre in the core of the infestation. Delimitation and often mass trapping are done after an eradication program to determine if eradication has been accomplished and to locate as precisely as possible any residual population. Table 1 summarizes 11 western states carrying out gypsy moth detection programs in 1989 and projected eradication programs for 1990. A total of 5 states are planning eradication programs for 1990 at up to 13 different sites.

There have been a total of 65 gypsy moth eradication programs in 6 western states beginning as early as 1977 in California, and most recently in Utah in 1989 (Table 2). All have apparently been successful or are currently in progress. A variety of eradication methods, including the use of chemical (Sevin, Orthene and Dimilin) and biological insecticides (Bacillus thuringiensis or B.t.) mass trapping, and F_1 sterile releases have all been used successfully under certain conditions. Eradication of isolated infestations is believed to be cost effective when compared to perennial control costs and losses associated with a general infestation.

USDA-Animal and Plant Health Inspection Service (APHIS) has drafted a National Gypsy Moth Survey Plan to assist states in designing survey programs. It sets trapping levels for any area based on the risk of introduction and presence of suitable habitat. The goal of the plan is to detect infestations before they become larger than one square mile in size, in order to keep subsequent eradication programs as small as possible. We feel however, that these criteria may be inadequate to meet the stated goal of detecting isolated infestations before they reach a certain size. For example, many people are moving into rural, small town areas in the west. Under this plan, such areas would only be trapped at a density of 1 trap/4 mi^2 every 4 years (1 trap/16 mi^2 every year). Our experience in Oregon suggests that these levels may not be adequate to detect infestations soon after introduction. Oregon has had at least five infestations in precisely these types of areas.

Early detection of infestations should be the goal of all western states. Expanded detection trapping in some western states is needed. The USDA-APHIS National Survey Plan is a good place to start; however, the lower densities and frequencies of detection trapping specified in the National Survey Plan may allow infestations to grow larger than one square mile in size before detection, and thus add increased cost, inconvenience, and possibly lengthen the duration of eradication programs. Western states need to be prepared with adequate detection programs and sound eradication tools to prevent the gypsy moth from becoming more than an unwelcomed visitor in the west. We also ask that when you move, please, don't move gypsy moth.

Table 1. GYPSY MOTH DETECTION PROGRAMS BY STATE: 1989

State	No. Traps	No. GM's	No. Sites	No. Eradication Sites in 1990
AZ	850*	0	-	-
CA	20,800*	56	10 + 13 singles	2
CO	4,267*	10	2 + 1 single	1
ID	9,644*	69	3 + 1 single	2
MT	1,507	1	1	-
NM	800	1	1	-
NV	750*	1	1	-
OR	22,257*	2	1	-
UT	4,328*	2,283	3 + 1 single	3
WA	8,471*	202	8 + 5 singles	5
WY	800	6	2+1 single	-

* Trap number includes mass trapping and delimitation traps from 1988 detection sites.

Table 2. NUMBER OF ERADICATION PROGRAMS AND METHODS USED BY STATE

	CA	WA	OR	CO	ID	UT
Chemical: Sevin	20		1			
Orthene		8	1		2	2
Dimilin	2					
Bacillus thuringiensis	4	7	12	2	2	1
Mass Trapping	1	7	13	4	2	3
F_1 Sterile Release		2	1	1		
Total*	22	18	16	4	2	3

* Some were multi-year programs during which more than one method may have been used in a single eradication program.

BIOLOGY OF THE GYPSY MOTH IN WESTERN NORTH AMERICA: HOST PLANT TESTS AND EFFECTS OF BT ON NONTARGET LEPIDOPTERA

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The first through fifth instars of the gypsy moth were tested for development to adults on 326 species of dicotyledonous plants in laboratory feeding trials. Among accepted plants, differences in suitability were documented by measuring female pupal weights. The majority of accepted plants belong to the subclasses Dilleniidae, Hamamelidae, and Rosidae. Species of oak, maple, alder, madrone, eucalyptus, poplar, and sumac were highly suitable. Plants belonging to the Asteridae, Caryophyllidae, and Magnoliidae were mostly rejected.

Foliage type, new or old, and instar influenced host plant suitability. Larvae of various instars were able to pupate after feeding on foliage of 147 plant species. Of these, 101 were accepted by first instars. Larvae from the first through fifth instar failed to molt on foliage of 151 species. Minor feeding occurred on 67 of these species. In general, larvae accepted new foliage on evergreen species more readily than old foliage.

The results of these trials were combined with results from three previous studies to provide data on feeding responses of gypsy moth larvae on a total of 658 species, 286 genera, and 106 families of dicots. Allelochemic compositions of these plants were tabulated from available literature and compared with acceptance or rejection by gypsy moth. Plants accepted by gypsy moth generally contain tannins, but lack alkaloids, iridoid monoterpenes, sesquiterpenoids, diterpenoids, and glucosinolates.

The development of gypsy moth larvae was monitored in the laboratory on the foliage of 39 species belonging to 18 genera in the Araucaraceae, Cupressaceae, Ginkgoaceae, Pinaceae, Taxaceae, and Taxodiaceae. Larval survival through successive molts, time of larval development, live female pupal weights, and adult female production of ova were measured as indicators of host plant suitability for the gypsy moth. The criteria for distinguishing the most suitabile hosts were: 1) greater than 80% survival of first instar larvae, 2) development to pupation in less than 41 days, 3) female pupal weights over 1099 mg, and 4) the production of more than 350 ova. The most suitable species were in the Pinaceae, in particular, *Cedrus deodara* (Roxb. ex Lamb.) G. Don, *Larix decidua* Mill., and *Picea pungens* Engelm. The least suitable species were in the Cupressaceae, Ginkgoaceae, and Taxaceae. First, second, and third instar larvae often differed in their ability to survive on new foliage compared with foliage from the previous year. Overall, first instar larvae succesfully developed into adults on 20 of the species tested but second instar larvae developed into adults on 29 of the species tested. First through fourth or fifth instar larvae failed to develop into adults on 8 of the species tested.

Species in a guild of nontarget leaf-feeding Lepidoptera on Garry oak, *Quercus garryana* Dougl., were monitored in the field for a period of three years (1986-1988) to assess the ecological effects of three applications of the microbial pest control agent, *Bacillus thuringiensis* Berliner var. *kurstaki* [Btk] within a single season application (spring 1986). The target species for the Btk application was the gypsy moth, *Lymantria dispar* (L.), in a large-scale eradication program in Lane Co., Oregon. Species richness in the guild of leaf-feeding Lepidoptera on Garry oak was significantly reduced in the treated plots during all three years of the study. Also, the total number of individual nontarget Lepidoptera was significantly reduced in treated plots in the first two years but not in the third year. These data suggest that certain nontarget species of Lepidoptera may be ecologically 'at risk' in large scale Btk-based pest control programs. Variables, such as phenology, voltinism, and plot size, are discussed regarding the degrees of risk and type of species that may be most affected by large-scale MPCA control/eradication programs.

"WHAT - ME WORRY?"

Observations by R.W. Stark

For those of you unfamiliar with the writings of the 20th century philosopher, Alfred E. Neumann, the quotation used as a title for my viewpoint is particularly apt. I do not have to worry about angering Ladd or any of the pest management people here since I am retired and it reflects my view of the gypsy moth presence in the west.

Ladd was fully aware what the tenor of my comments would be but invited me as a stand-in for Don Dahlsten in spite of that. He knows full well that my efforts will be the equivalents of urinating into the wind. You ask - then why bother us? Other than the opportunity to parade my erudition, my motive is that perhaps my words might reach some of the younger scientists and pest managers, causing them to question more deeply, to consider their actions in a broader ecological context, and to accept the status quo less docilely.

I will be saying things that will raise the hackles of many of you. Normally, hackle-raising seals ears and freezes intellects so that any statement, no matter how profound or true is unheard, ignored, or discredited. I rely upon your intelligence and courtesy to suppress your emotions and LISTEN - truly listen- and THINK rather than react.

Now to the gypsy moth. This successful inhabitant of hardword forests arrived on our shores in 1869. Since that time it has inexorably spread into all habitats that it found to its liking in spite of the expenditure of many millions of dollars to eradicate or contain it. It has been transported to many environments in the west that it is still testing. Whether it will remain is still undecided but experience tells us that if it decides to stay, it will.

This observation brings me to my first reason for foregoing further attempts to eradicate the gypsy moth in the west. It is that such attempts are eventually EXERCISES IN FUTILITY.

Some of you undoubtedly said, "Many millions? Come on!". Attempts to eradicate the GM began almost immediately after its presence in forest stands was discovered. Between 1869-1900 an estimated $1.2 million (=18.2 million 1990 dollars) was spent. Annual expenditures increased in direct proportion to the increase in GM populations (THINK ABOUT THAT!). Sometime in the 70's it became a fixed line item in the federal budget - in the past two decades from 3-6 million dollars per year of federal funds and a comparable amount from state and local governments has been expended in this 100-year "war".

Thses facts may inspire the cynics among you to see another reason for leaving the beast alone to prosper - as the Gypsy Moth prospers so will the research and pest management economy of the western states and provinces.

In spite of these huge expenditures the 9 pound, $15 million GM Compendium which summarizes the knowledge gained from 1869 to 1981 does not contain an adequate method for determining impact on timber values

let alone any other resource nor a successful permanent method of preventing population increases let alone eradicating the gypsy moth. I quote: "One of the biggest missing pieces to the impact assessment puzzle is information on expected tree mortality following a regime of gypsy moth defoliation." This after almost a century of observation and research. After a thorough analysis of the GM Compendium and other descriptions of eradication efforts, I was reminded of the response of inveterate smokers to the latest method of swearing off the weed - "It's easy, I've done it hundreds of times."

Do we really believe our western scientists and pest management people will succeed where the eastern armies have failed?

Do we really believe that we have detected every gypsy moth immigrant to the west? Consider all the ways the insect can enter our sacred borders. Every auto, truck, RV, and perhaps aircraft coming from the east at the right time can transport them. There are thousands of miles of highways, millions of stopping places, hundreds of millions of potential hosts, billions of hiding places. So with our puny efforts at trapping and spraying we kill a few hundred here and there. Do we really believe these are all that are lurking out there ready to pounce? (My God, I'm beginning to talk like a pest manager!!) Do we really believe that every eradication treatment was successful and the latest detection report represents a new introduction?

P.T. Barnum profited greatly from his knowledge of human nature. I'm not suggesting that the practitioners of pest management are deliberately preying on the piscatorial characteristics of the public, but do we really believe the claims made by those in the eradication game? For those that do, I would recommend an immersion course in reading the reports of all extermination efforts followed immediately by the justification section of requests for funding in the year following eradication. After this course, I would like a list of those that still do - I have a friend selling real estate in Nevada who would pay handsomely for it.

The only life forms we have been successful in eradicating are those we can eat, wear, or otherwise exploit for profit. As Buzz Holling once suggested, perhaps we should try to manage the gypsy moth - resurrect the spirit of Leopold Trouvelot and try to establish a silkworm industry in America.

The "Wars of Eradication" have without question hindered the assimilation of the GM into natural ecosystems. There are many other introduced insects and other life forms which have created some panic but for some reason have not enjoyed the limelight that the GM did. They eventually became relatively innocuous citizens of the forest world. Perhaps if we left the GM alone, it too would disappear from the public enemies list.

My closing argument for letting the GM find its niche without interference is that the mounting campaign against the dreaded lepidoptern hordes is an insult to the intelligence of the public and the scientific community. It is a regression to the militaristic jingoism that permeated pest management just a few short years ago (like a bad bathroom odor which lingered but did not prevail). I support my contention with a few quotes from a recent publication - "Gaining support

for (I call it Oz to avoid a libel suit) Gypsy Moth Wars 1978-1988. A case study in public relations".

"For over a decade,...[the Munchkins]...have led the way in a series of successful eradication projects." If they were so successful, why has it been found necessary to create a bureaucracy suspiciously similar to the eastern one to continue to eradicate what has been "successfully eradicated"? I found it interesting also that several of the eradication attempts repeated procedures discredited in the east.

"[We are dedicated] to keep [Oz] free of foreign pests such as the gypsy moth."

"A public information campaign launched by [the government] distributed lengthy fact sheets filled with scientific data while [the opponents of spraying] bombarded the [residents] with bold anti-spraying statements and misinformation." I presume that I need not tell you that publication quoted is a government one.

"At one point it appeared as though the treatment effort would never be attempted and the gypsy moth would multiply and establish itself in [Oz]". It is established and it will multiply - such rhetoric notwithstanding.

What is truly amazing and depressing about this publication is that it is a blatant description of how to mobilize the public to support the war - nowhere is there any attempt to examine whether the war is necessary. Unfortunately, it is but one of many of that ilk.

Earlier, I mentioned a reason rooted in greed for letting the gypsy moth run its course. I close with another somewhat conciliatory olive branch for pest management - a justification for continuing the exercise (I refuse to call it war) and a sure-fire eradication technique.

The confrontations with an aroused public have hastened the refinement of behavioral chemicals and B.t. technology and encouraged their use. There may be a backlash, however. When it becomes apparent that the "war" has been lost, behavioral chemicals or B.t., or both may serve as convenient scapegoats.

The technique is an ancient tried and true one. Last year in Sandpoint we spent about $80,000 spraying an estimated few dozen GM over several city blocks. With this kind of money we could offer a $500 bounty for every cocoon and/or egg mass and provide training for the citizens of the Panhandle. I guarantee there would not be GM left within the city limits.

Rationale Behind Eradicating Isolated Infestations of the Gypsy Moth in the West

Robert V. Dowell
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Pest Detection/Emergency Projects Branch
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1220 N Street, Sacramento, CA 95814

No one can predict exactly what gypsy moth will do in the West. All we can do is examine closely what the insect does in the East, how it behaves in isolated infestations in the West, and attempt to extrapolate into the future. We do know that the pest is constantly expanding its current range to the north, south , and west, that it is continually being brought into the West as eggs and pupae on cars, firewood, etc., and that it finds suitable food and climate to establish infestations in the West. We know that the larvae find numerous western native, naturalized, and ornamental plants suitable for completing their development and that these plants are important parts of our riparian, urban, oak, and mixed forest habitats. Lastly we know that no one has successfully managed the pest in the East, that defoliation reached nearly 13 million acres (20,000 square miles) in 1981, and that annual defoliation regularly runs at 1 million or more acres.

Critics of the tactics currently used by state regulatory agencies against gypsy moth accurately point out that these facts do not guarantee that the moth will behave in the West as it does in the East or that it will become a major western pest. They note that several other "potential" forest pests failed to live up to their advance billing when they came west. These critics play an important role in ensuring that western decision makers examine all the facts and options before deciding on a course of action concerning the gypsy moth. These critics are in the enviable position of not being held responsible for their actions or lack thereof as are we in state regulatory agencies. Such responsibility makes us conservative, especially when faced with figures like those in Table 1, which are generated by University of California scientists and which estimate the costs of a 20 year, statewide gypsy moth infestation in California.

If we act and our critics are correct, we have wasted money. If we do not act and the estimates in Table 1 are correct, we will be severely chastised by elected officials, citizens, and many of the same critics. Based upon what we know about gyspy moth in the East, we believe that the estimates in Table 1 more correctly predict what the moth will do in the West than those people who predict little to no impact.

Lastly, no one believes that we can keep gypsy moth out of the West forever. We can forestall its arrival and hope that it arrives only after effective control measures beyond broad scale pesticide sprays are developed to help us deal with the pest.

Table 1. Cost estimates for a 20 year, statewide gypsy moth infestation in California.

Activity	Costs in $
Agricultural control costs	1.5 million
Private tree removal and replacement	570 million
Outdoor recreational losses	125 million
Clean-up costs	397 million
Public tree removal and replacement	124 million
Public recreation losses	41 million
Reductions in private property values	1.2 billion
Total	2.5 billion

PANEL: ADVANCES IN FOREST INSECT RESEARCH
Moderator: John McLean
Panelists: Boyd Wickman, Staffan Lindgren, Lee Humble

In this time of changing emphases by the major forest research managers at the federal levels in both Canada and the United States it is timely to consider what we are doing at this time. As we look to the future, what can our new graduates in Forest Entomology expect as career opportunities? Certainly there are going to be team approaches to solving perceived "current problems". What of long term research? We must be alert to current changes and perhaps management objectives will be clearer by next year's National meeting in Denver.

Survey of Bark Beetle Research - Staffan Lindgren,
Phero Tech Inc., Delta, British Columbia.

A questionnaire was sent to 47 researchers throughout Canada and the U.S.A. to survey bark beetle research. The response was overwhelming, with 44 questionnaires returned, of which 42 (89.4 %) indicated some activity, while two (4.3 %) responded that they were not involved in bark beetle research. One response was late, so only 41 responses are included in this summary.

Caution is recommended in interpreting the results since: 1) The analysis is purely qualitative, i.e. the level of activity is not accounted for; and 2) The questionnaire is inherently biased in favor of a) WFIWC participants, b) pheromone researchers, and c) scientific research as opposed to operational research conducted by FPM personnel. I apologize sincerely to those researchers that were missed.

In general, the results held no surprises (Fig. 1). There seems to be some emphasis on host plant-insect interactions and population dynamics, particularly in the south. Possibly, this is due to a high level of university involvement in research on the southern pine beetle. There is considerable overlap in approach by many researchers. Unique projects included the role of root-infesting insects in predisposing trees to attack by *Ips pini*; a study of endemic populations of the mountain pine beetle; the use of acoustics to locate southern pine beetle spots; and a study of kairomones of southern pine beetle parasitoids.

Many species of bark beetles are under study, particularly in the genus *Dendroctonus* (Table 1). The only real surprise was that only one responder was working on the western pine beetle (plus the late responder) in spite of its importance.

My conclusion is that we are lacking in new and exciting approaches to bark beetle problems, and that there is a fair amount of overlap among research groups working on the same organism. In my view, there is a definite need for studies on endemic populations, and the factors which contribute to regulate these. The use of models for assessing control treatment effects, particularly at the population level, deserves more attention.

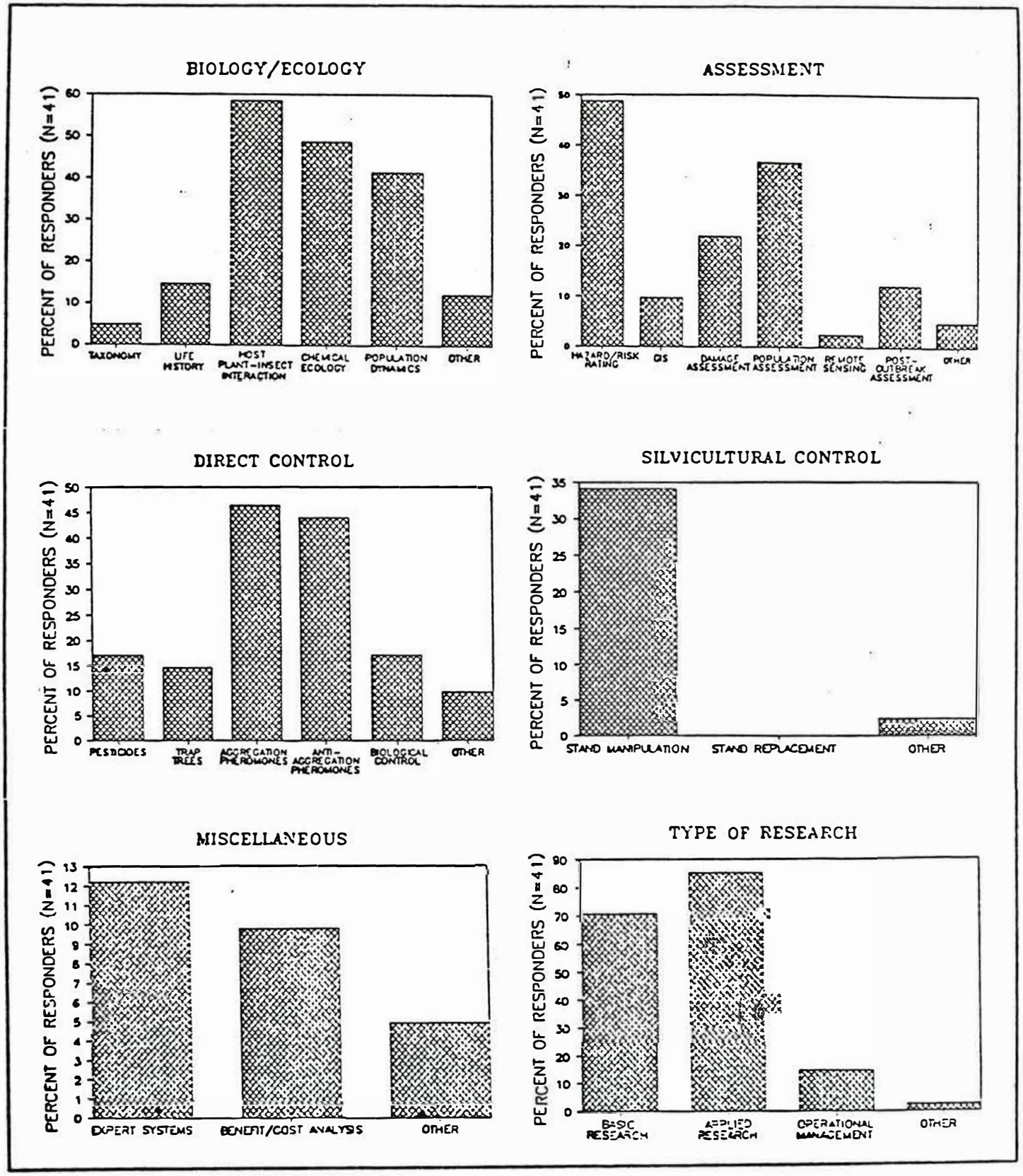

Figure 1: Results of survey questionnaire on current Bark Beetle Research by members of the Western Forest Insect Work Conference. Statistics compiled by Staffan Lindgren.

Table 1. Bark beetles currently being studied by members of the Western Forest Insect Work Conference as determined by a survey of 44 researchers.

Species	Number	%
Dendroctonus brevicomis	1	2.4
Dendroctonus frontalis	11	26.2
Dendroctonus ponderosae	18	42.9
Dendroctonus pseudotsugae	5	11.9
Dendroctonus rufipennis	8	19.1
Dendroctonus simplex	1	2.4
Dendroctonus terebrans	3	7.1
Dryocetes confusus	1	2.4
Hylastes/Hylurgops spp	2	4.8
Ips avulsus	3	7.1
Ips calligraphus	5	11.9
Ips grandicollis	3	7.1
Ips perturbatus	1	2.4
Ips pini	7	16.7
Scolytus ventralis	2	4.8
Ambrosia Beetles	3	7.1
Other	4	9.5

Some New Pests of Regeneration. Lee Humble,
Canadian Forestry Service, Victoria, B.C.

A brief review was presented of current research on the black army cutworm, *Actebia fennica*, in British Columbia. Detailed studies have been carried out on the amount of damage the black army cutworm does in new plantations. There seems to be a direct relationship between the use of slashburning for site preparation and outbreaks of this pest. Other new pests in B.C. include the weevil *Pissodes schwarzi*, around the base of young lodgepole pine trees. In addition, several plantations in the Kispiox District have high levels of Warren's root collar weevil, *Hylobius warreni*.

Current Advances in Defoliation Research. Boyd Wickman.
U.S. Forest Service, La Grande, Oregon.

I sent letters requesting information on newly published or nearly completed research to 27 western researchers. I received abstracts from 12 people. I did not include summaries of work in progress. The titles are arranged in three broad categories (Table 1): Population Dynamics and Sampling, Insect/Host relations, and Management Techniques. Based on the replies, even though a small sample size, there was more research in Insect/Host Relations reported than in the other two categories. This is consistent with the current trend in defoliation literature.

- Population Dynamics and Sampling

1. Dynamics of DFTM - study of multiple interactions.
   Jeff Millstein, Washington State University, Pullman.
2. Simultaneous monitoring of DFTM and WSB using lower crown branch samples.
   Richard Mason, USFS, La Grande, OR.
3. Developing sampling methods to measure damage caused by WSB in the southwest.
   Ann Lynch, USFS, Ft. Collins, CO.
4. Effect of drought on sawfly dynamics.
   Michael Wagner, N. Arizona Univ., Flagstaff, AZ.

- Insect/Host Relations

1. Phenology of white fir and DF with and without mistletoe in WSB outbreaks in the southwest.
   Ann Lynch, USFS, Ft. Collins, CO.
2. Dwarf mistletoe/WSB/Douglas-fir relations.
   Greg Filip *et al.* (6 authors), USFS, La Grande, OR.
3. Western spruce budworm nutritional ecology.
   Karen Clancy, USFS, Flagstaff, AZ
4. Effect of thinning and fertilization on WSB and tree growth.
   Boyd Wickman and Dick Mason, USFS, La Grande, OR.
5. Black army cutworm damage to seedlings.
   Roy Shepherd and Tom Maher, CFS, Victoria, B.C.
6. Phytophage effects on primary production of young Douglas-fir in western Oregon.
   Tim Schowalter *et. al.* Oregon State Univ., Corvallis, OR.

- Management Techniques

1. Synthetic sex pheromone test to control DFTM in California.
   Lonne Sower, USFS, Corvallis, OR
2. Long-term effects of carbaryl and *B.t.* treatments on WSB populations.
   Torolf Torgersen, USFS, La Grande, OR.
3. Thinning of DF by WSB.
   Rene Alfaro, CFS, Victoria, B.C.

WORKSHOP: STATUS OF INSECT PEST MODELS
Moderator: Bov B. Eav
Participants: Bov B. Eav, John Heasley, Lance David

The workshop consisted of three sessions:

* Presentation on the status of the insect pest models maintained by the Methods Application Group at the National Computer Center in Fort Collins, Colorado (NCC-FC)

* Demonstration of the visual display of the impact of mountain pine beetle infestation on lodgepole pine stands

* Demonstration of the submittal system residing on the Forest Service's Data General computer which acts as an interface between forest pest models and their users.

1. STATUS OF INSECT PEST MODELS AT NCC-FC: Bov B. Eav

The Methods Application Group maintains three insect pest models at the NCC-FC. These population dynamics and impact models are linked to the Prognosis growth-and-yield stand projection system.

Mountain Pine Beetle Model - This model consists of an impact-only model (the Cole Model) and a combination population dynamic-impact model (the Burnell Model). Both of these models operate only in lodgepole pine stands. The Cole Model predicts lodgepole pine mortality in an outbreak as a function of tree diameter and previous year mortality. The Burnell Model simulates beetle population dynamics and projects mortality as a result of the outbreak. Both models can be initiated either by the user specifying the outbreak year or automatically by the model when the drawn random number is less than or equal to the computed probability of outbreak. The probability of an outbreak is a function of crown competition factor and the proportion of stand basal area in lodgepole pine.

Western Spruce Budworm Model - The Western Spruce Budworm Model integrates results of the Canada/United States Spruce Budworm research program often referred to as CANUSA. It can be used in any one of three modes: (1) as a stand alone model for predicting budworm population dynamics, effects of budworm on host tree foliage, and their interaction, (2) as a damage model which uses budworm defoliation to modify tree growth and mortality projected by Prognosis, and (3) as a full model which can be used to make long-term projections of budworm population dynamics, tree defoliation, and effects on stand development. The Western Spruce Budworm Model is under revision by the Intermountain Forest Experiment Station of the USDA Forest Service to correct some deficiencies in the budworm population dynamics portion of the model.

Douglas-fir Tussock Moth Model - This model simulates the insect population dynamics and resulting defoliation during a tussock moth outbreak and projects the impact of the outbreak on stand development through its linkage with Prognosis. A team of specialists from Forest Pest Management and researchers from the Pacific Northwest Research

Station are reanalyzing old data and evaluating recently collected data to enhance the model and alleviate some of its known weaknesses.

2. VISUAL DISPLAY OF MOUNTAIN PINE BEETLE INFESTATION: John Heasley

The demonstration illustrates a visual display of the consequence of a mountain pine beetle outbreak in a lodgepole pine forest in Montana. The resulting damage and its visual consequences are displayed for three treatment options: no-treatment, clearcut, and thinning. The view scenes were generated by a visual impact model implemented within the Integrated Forest Resource Management System (INFORMS) using digital elevation data and stand data generated by the Prognosis-mountain pine beetle modeling system. Both maps and perspectives for the three treatment options can be displayed at the user's request.

3. DEMONSTRATION OF THE PEST MODEL SUBMITTAL SYSTEM: Lance David and Bov Eav

The submittal system is a computer program residing in the USDA Forest Service's Data General computer which provides the interface between the user and the forest pest simulation models. The submittal system, in conjunction with the growth-and-yield submittal system, assists the user of growth-and-yield/pest models to access stand data, write commands to control the models, and process model outputs.

The presenters executed the submittal system program, which resides in the Panhandle National Forest Data General computer, to submit a Prognosis/mountain pine beetle simulation exercise. The ease of use was emphasized. Going through a series of menu screens the presenters were able to develop a complete runstream to be sent to the NCC-FC computers where the models reside. Through the submittal system the user is not required to know the NCC-FC job control language or the complicated keywords used to control growth-and-yield and pest models. The user need only know the name of the stand data file, the nature of the pest operating in the stand, and the desired silvicultural and pest control prescriptions to be applied to the stand.

WORKSHOP: PEST CONSIDERATIONS IN UNEVEN-AGED MANAGEMENT (UAM)
Moderator: Boyd Wickman
Participants: Jay Berube, Gary Peterson, Karel Stoszek, Ken Gibson, plus 30 others

Jay Berube, Silviculturist for the Colville NF and a member of the Forest Service R-6 Uneven-aged Management Task Force, gave the group an overview of UAM as envisioned by Region Six, USFS practitioners. Some points that Jay made were that this silvicultural system has different goals for different publics so we need some new silvicultural definitions for UAM. Target stands need to be carefully defined by species composition, structure, cutting cycle, size of units, etc. There will probably be limited use of fire in order to protect regeneration and there may be some fuel buildups because of more frequent logging entries. The technique is going to require more careful road construction, planning, and on-the-ground supervision so it will be more expensive. Pest problems like root diseases, mistletoe, and some defoliators may be more of a problem, but bark beetles may be less important. This will be a new way of doing business and budgeting will have to be more carefully integrated with other activities on the sites and be longer term.

Karel Stoszek asked why the Forest Service was not using more sources of information like studies being conducted at U. of Idaho and the Yakima Indian Reservation's operational use of UAM for some years. He also pointed out that U. of Idaho and Oregon State University are planning a UAM field trip on the Wallowa-Whitman National Forest in July 1990. Gary Peterson, Silviculturist on the Sisters Ranger District of the Deschutes NF, thought that perhaps UAM is being oversold and the negative aspects undersold. It will probably be best suited for ponderosa pine type with more pest problems in the mixed conifer type.

Some participants also pointed out that UAM techniqes should also be considered in the context of other programs like New Perspectives in Forestry and Global Changes. This is going to require a broader ecological and landscape level perspective. We also need to be site and species specific when we make recommendations on UAM in relation to pest management and forest health.

WORKSHOP: FPM SERVICE AREAS/FIELD OFFICES- PROS AND CONS
Moderator: John Wenz
Participants: Jill Wilson, Bernie Raimo, Dave Schultz, Jed Dewey, Bill Ciesla, Sandy Gast, Don Scott, Ken Knauer, Tim McConnell, Andy Eglitis, Ralph Thier, Dave "Red" McComb

Over the past couple of years, FPM has placed pest management specialists in several new field locations throughout the West. The intent of this workshop was to discuss the pros and cons of field unit implementation to date. Forest Pest Management field units have recently been established in the following locations: R2- Rapid City, SD, Service Center (1988) and Gunnison, CO, Service Center (1988); R3- New Mexico Zone Office, Albuquerque, NM (1988) and Arizona Zone Office, Flagstaff, AZ (1988); R5- Northern California Shared Service Area, Redding, CA (1988) and South Central Sierra Service Area, Sonora, CA (1988); R6- LaGrande, OR, Field Office (1988) and Bend, OR, Field Office (1989). Region 4 has had Field Offices in Boise, ID and Ogden, UT since about 1964. Region 1 established a Field Office in Coeur d'Alene, ID, with a nursery specialist in 1988, followed by an entomolgist and a pathologist in 1990. Additional new field units are planned in R1-(1), R5-(2) and R6-(1).

Representatives from the field units discussed organizational structure, size of the area, number of NFS, other Federal, and state agency "clients" served by the unit, budget consideratons, facilities, and the problems and benefits that have surfaced since establishment. The main organizational difference identified centered around supervisory structure. Regions 1, 2, 3, and 4 retained supervisory and budget control in the Regional Office while in Regions 5 and 6, supervisory responsibilities were assumed by the National Forest where the field unit was located and budgets are negotiated with the Regional Office but distributed to the home forest for management. In R5, a "steering committee" composed of a representative from each NF and National Park within the service area, meets at least once a year to review accomplishments and develop work plans. No major problems were identified with either type of organizational structure; aside from overhead, the integrity of FPM budgets sent to the forests has been maintained and non-pest management related demands on FPM personnel by the forests have been minimal. Coordination with other Federal and state agencies with the field unit areas of responsibility has proceeded well and coordination with FPM-RO and other "central" agency units has generally been adequate. Some problems with the availability of lab facilities were identified.

Comments from participants concerning how the field units have been functioning so far were positive as has been the feedback from National Forests and other "clients". Functional areas specifically noted included 1), increased and more efficient contacts with field-level resource managers resulting in improved technical assistance; 2), increased participation in, and input to, NEPA and LMP related activities; 3), increased opportunities to monitor prescription implementation and other resource management actions; 4), increased utilization of basic pest management training and training "customized" to meet specific client needs; and 5), increased/more efficient contacts

with other Federal, state and local agencies resulting in better technology assistance. Both R5 and R6 perceived that establishment of the field units had helped the NF's recognize their pest management responsibilities and accept pest management as part of their overall forest management program. Region 6 commented that the Field Office workload seems to warrant additional support in the form of biological technicians and/or co-op education positions.

One area of concern that surfaced, given the trend toward decentralization, involved defining the role of FPM in the Regional Office. Forest Pest Management and client National Forests in R1 and R6 have expressed the desire to retain certain roles and responsibilities in the RO. These include 1), development and coordination of pest management policy and direction; 2), aerial survey/detection capabilities; 3), expertise needed to plan, coordinate, and conduct large-scale suppression projects; 4), pest management expertise in specialized functional areas (e.g. nurseries, breeding orchards, tree improvement centers); and 5), other support areas such as GIS, technology transfer, impact assessment etc.

Region 1 commented that the National Forests in their Region felt the service provided by FPM out of the Regional Office was more than adequate and that there was no reason to decentralize into field units. The forests in R1 felt that such a move could lead to the development of "generalists", and that in time, specialist expertise might not be readily available to the Region as a whole. They also expressed the concern that decentralization could decrese the time available for technology development/transfer activities. It was pointed out that the motivation for creating the field units in the other Regions did not arise from identified problems in the level or quality of current support provide by FPM out of the Regional Offices, but rather was an attempt to further improve service. The move to create more FPM field units was supported by the client National Forests in Regions 2, 3, 5, and 6. Workshop participants generally felt that there were no inherent advantages to any particular organizational structure, and that each Region should be free to organize in a manner most appropriate to that Region based on FPM and client agency needs.

WORKSHOP: INSECT PHEROMONES FOR CONTROL
Moderator: Peter M. Hall
Participants: Staffan Lindgren and workshop attendees

This workshop was well attended by approximately 50 participants. The session was unstructured with only one arranged speaker (Staffan Lindgren) and even he did not finish his prepared presentation. Discussion was good with a high level of participation by attendees.

The workshop discussed the strategies and applications of semio-chemicals for control of forest insects. In both the U.S. and Canada the use of baits for management of mountain pine beetle is quite well understood and accepted as operational. There is, however, considerable interest and need for operational repellent chemicals for such insects as mountain pine beetle, Douglas-fir beetle, and various species of Ips. The situations identified as most appropriate for use of repellents include protection of ski resort areas, recreation areas, and other high use, high value sites where treatment costs could be substantially higher than in timber production areas. The issue of "amenity forestry" permits a wider selection of treatments as costs do not matter as much. Other places where repellents would be of use is in protection of residual stems after thinning operations (this relates to preventing attack by Ips).

The use of pheromones for control of defoliators was also discussed in relation to mating disruption and mass trapping. These strategies have been shown to be effective especially for such insects as shoot moth and Douglas-fir tussock moth. The main problem now is one of pheromone supply; for example, the only commercial supplier of the pheromone for Eucosma in the U.S. is now out of business and no others have the license for production. Further, commercial suppliers may hesitate to become involved with this type of product simply because the expected volume of use is quite low.

As discussed above, the strategies for use of pheromones such as repellents are already established. The flaw now is the fact that those proven repellents, such as MCH (for Douglas-fir beetle) and verbenone for mountain pine beetle, are not registered for use in either the U.S. or Canada. Registration of these chemicals is expensive for a private company especially in light of the expected level of use. Therefore there is a feeling of frustration on the part of operational pest managers. There are also a wide variety of bark beetles and defoliators where pheromone strategies exist and where there is a high likeli-

hood of pheromone moderation of behavior, but where no work is being done to develop the pheromone. For instance, there were at least 4 species of Ips mentioned in the workshop as deserving of control; however, only one commercial company seems to be developing tools for but one of these. Government and university research and operations groups do not appear to be leading the way in this area or establishing long term goals and directions.

There is no coordination of research effort to determine a prioritized "hit" list of target pests and there is no concerted effort by government to ensure that suppliers of these chemicals will exist. It may be best in the long run if government agencies in Canada and the U.S. assume the responsibility of setting priorities and assume the costs of preparing registration tests and documentation. Once registered, specific pheromones could be licensed to commercial producers.

The consensus of the session seemed to be an endorsement of the use of this pest management technique. It became evident, however, that coordination of the development effort is required. The use of pheromones (both attractant and repellent) for control purposes has been discussed for many years. However, to date, relatively few have actually been delivered to the operational setting. With the increasing interest in "amenity forestry" and non-pesticide approaches, the issue of coordinated development and delivery of pheromone tools should be explored by the appropriate management and regulatory agencies.

WORKSHOP: INSECT IDENTIFICATIONS AND U.S. HOPKINS SYSTEM
Moderator: Torolf R. Torgersen
Participants: Sandy Gast, Carma Gilligan, Lee Humble, Tim McConnell, Dick Schmitz.

The focus of the workshop was to discuss taxonomic services, and to outline the history and current status of the Hopkins U.S. System and the Canada Forest Insect and Disease Survey System for recording insect collection/identification records.

Taxonomic services in the United States are provided by specialists in the Systematic Entomology Laboratory (Agricultural Research Service), and the Smithsonian Institution, U.S. Museum of Natural History. Cuts in the staffs of both units have left some taxa without specialists for doing identifications. Taxa with agricultural importance apparently have top priority for taxonomic services. Participants voiced frustration over their inability to obtain identifications of some taxa, or to obtain timely identifications of taxa for which there are specialists. Torgersen will investigate current protocols with ARS and USNM to try to resolve barriers to obtaining determinations in the future. In Canada identifications are provided by entomologists with the Forest Insect and Disease Survey (FIDS), and by specialists at the Biosystematics Research Centre of Agriculture Canada.

Torgersen described the evolution of the Hopkins US System from its original structure as envisioned by A.D. Hopkins in the late 1890's, to its current form. Through the efforts of Mel McKnight (FIDR, retired), with support from Forest Insect and Disease Research Director Jim Stewart, all the original Hopkins Number cards from Forest Service units nationwide have been microfilmed and mounted in microfiche cards. Sets of microfiche have been distributed to all units from which the cards originated, plus other interested units. Through a cooperative agreement with West Virginia University, with funds supplied by Forest Insect and Disease Research (WO), Hopkins US Number-Card data files have been created on IBM PC-compatible equipment and transferred via modem to the Washington Office DG system. The data files can be processed with DG-resident software such as Forms Entry System and PRESENT to produce reports in desired formats, and copies retrieved to Forest Service field units. Reports can be produced by using query formats that sort on insect species (including parasitoids), host tree or insect, locality, or collector. Discussion centered on where the Hopkins U.S. System Index (HUSSI) would be stored, how it could be queried, and how it could be updated and revised to account for synonymy.

Lee Humble, Forest Insect and Disease Survey, Forestry Canada, Victoria, B.C., gave a detailed account of the computer-based structure of the sophisticated Canadian System (FIDS INFOBASE) used for insect and disease records. He outlined how the data were generated in the field, coded, entered in the database, and how textual and graphic reports could be generated. The Canada Forest Insect and Disease Survey has been in place since 1936 and has generated more than 1.3 million pest-specific records. INFOBASE became operational in 1985, and is used routinely by the regional laboratories to enter, access, or update their records in the national database. Data stored in INFOBASE can also be mapped using Geographic Information System technology.

Final discussions centered on the desirability of a system combining the elements of the Canadian FIDS INFOBASE and U.S. HUSSI systems.

WORKSHOP: Silvicultural Control of Major Forest Insects
MODERATOR: Dayle Bennett
PARTICIPANTS: Approximately 50, including brief presentations or comments by Boyd Wickman, Gene Amman, Ken Gibson, Evan Nebeker, Charlie Sartwell, Andy Eglitis, John Hard, and Gary Petersen

Dayle Bennett introduced the workshop theme, "Silvicultural Control of Major Forest Insects," by giving a brief summary of Region Three's current emphasis on preventing major forest pest problems through silvicultural recommendations aimed at reducing susceptible forest conditions. He stated that this effort includes the use of hazard rating systems, prescription reviews, formulation of quantifiable stand and pest management objectives, and treatment alternative generation and prioritization through participation on District and Forest interdisciplinary teams.

Boyd Wickman discussed his recent study of fertilizer treatments to reduce western spruce budworm (WSB) damage. He has found that fertilization enhances foliage growth, resulting in more foliage than WSB can consume and increased tolerance of host trees to defoliation. Boyd plans to examine the effects of fertilizer on foliage chemistry and the effects of these chemical changes on WSB dynamics.

Gene Amman presented information from his studies involving partial cutting to reduce lodgepole pine losses caused by mountain pine beetle (MPB) outbreaks. He stated that short-term thinning strategies can substantially reduce losses from MPB when stand basal areas are reduce to about 80 square feet. However, longterm strategies should focus on creating mosaics of age, size, and species diversity.

Ken Gibson discussed an operational strategy of partial cutting on the Swan Lake RD, Flathead NF, in which the basal area of several cutting units, approximately 20 acres in size, was reduced from 160-180 square feet prior to thinning to 80-100 square feet following thinning. These thinned units of lodgepole pine remained protected from MPB attacks during a recent outbreak while adjacent uncut areas were heavily attacked.

Dayle Bennett presented information and concerns from John Schmid regarding difficulties in establishing longterm silvicultural plots to determine the effects on MPB outbreaks in ponderosa pine. These difficulties include a paucity of acceptable study areas, delays in treatment, felling and skidding damage to residual trees, subsequent windthrow in heavily thinned stands, and the relatively small size of plots.

Evan Nebeker discussed thinning studies in the Southeast which have shown that while wounding of residual trees resulted in growth loss, such wounding did not increase susceptibility to southern pine beetle attack.

Charlie Sartwell presented his observations of MPB activity in thinned ponderosa pine stands in Oregon. He noted that stands thinned 20 years ago to a 12 foot spacing resulted in no protection against MPB, while those thinned to a 15 foot spacing are just now coming under attack. Those stands thinned to 18 foot and 21 foot spacing remain unattacked.

Andy Eglitis discussed the 110,000 acre "Black Bark" thinning area in central Oregon. This project involves the aggressive thinning from below of 60 to 80 year old stands of ponderosa pine to a residual stocking of 60 to 80 square feet of basal area. The purpose of this project is to reduce stand susceptibility to MPB.

John Hard offered results of pruning studies he has done on spruce in recreation sites in Alaska. Pruning branches from the lower bole of large spruce has proved beneficial in reducing the incidence of successful attacks by spruce beetle. John surmised this reduction may be due to a change in microclimate around the pruned spruce boles.

Gary Petersen related plans to address "forest health" issues, primarily ponderosa pine losses due to a western pine beetle (WPB) outbreak, in an analysis of management alternatives for Camp Sherman Recreational Area, Sisters RD, Deschutes NF. Recommendations are to "open up" these overstocked stands in an attempt to reduce susceptibility to WPB while at the same time mimicking natural old growth ponderosa pine stand conditions.

WORKSHOP: PEST CONSIDERATIONS IN TREE IMPROVEMENT EFFORTS
Moderator: Mary Ellen Dix

Forest insects can adversely impact all stages of a tree planting program. Collection of scion wood for grafting and seeds for progeny tests may be delayed, of poor quality, or of insufficient abundance because borers and defoliators have damaged the superior tree candidates. Grafted trees may be damaged by insects that feed on the foliage, stems or roots, and by borers such as Dioryctria spp. that damage the grafts. Trees in progeny tests can be completely or partially destroyed by insects within the first few years after establishment. If too many trees are lost the statistical design will be compromised and it will be impossible to make evaluations. The growth rate and form of the progeny can be affected by insect feeding and birds landing and resting on young shoots. This damage can be mistaken for genetic defects.

Insects that damage progeny tests can also damage and kill trees in newly planted seed orchards. Seed yields from seed orchards are reduced not only by insect's damage to the seeds and cones, but also by defoliation. Tree and branch morality caused by bark beetles and other borers is a potential problem, especially during periods of drought.

Methods are available for the early detection and reduction or prevention of damage for many insects. Insect pheromones may be used to detect high populations of many adult species and can be used to prevent and reduce shoot borer and bark beetle populations in pine plantings. Silvicultural techniques such as thinning, watering, and sanitation often are very effective on small trees. Insecticides capsules designed to be implanted into the boles of individual superior trees are highly effective in preventing defoliation by the spruce budworm and possibly other pests. Insecticide sprays are available to protect young trees from damage by grasshoppers, tip moths and other pests. However, insecticide use is becoming more restricted because of concerns about environmental contamination, the high cost of registering insecticides, and insect resistance to insecticides. More effective alternative control methods need to be developed such as the use of resistant trees, natural enemies, insect pathogens, insect growth regulations, and pheromones.

Currently, most survey and control efforts against pests are responses to crisis situations. Long-term management guidelines for insect pests in tree improvement plantings need to be developed that identify potential pests and identify in advance effective methods for detecting and assessing these pest populations and several alternative methods for reducing and maintaining low populations. Information on long-term population trends is available for budworms, bark beetles, and gypsy moths but is lacking for most other pest species. This information can be used to predict outbreaks and develop long-term management guidelines. However, implementation of techniques for managing tree pests may be adversely impacted or prevented by environmental concerns, such as the Spotted Owl.

WORKSHOP: MAKING FOREST ENTOMOLOGY MORE VISIBLE WORKSHOP
Moderator: Bill Ciesla
Participants: Alan Berryman, Steve Burke, Chuck Dull, John McLean
Bob Coulson, and others

Session opened with the theme "How to Make Forest Entomology (and Forest Pathology) More Visible in a Positive Way". Type of audience, both internal and external was discussed and various ways of reaching audiences either through direct contact or via the media.

Subsequent discussion dealt with concerns about a decline in the number of forest entomologists in the West. In addition, forest entomologists are becoming more involved with interdisciplinary teams or in specialty areas such as modeling, remote sensing, GIS, biotechnology or pheromone chemistry. Consequently, the profession is becoming less visible.

Another issue discussed was how to maintain sufficient visibility to attract students for potential career positions in forest entomology and the type of education required to compete in today's job market.

WORKSHOP: PLANNING A SURVEY
Moderator: Michael A. Marsden
Participants: Bov B. Eav, Tim McConnell, Katharine Sheehan, Richard Myhre
Attendance: Approximately 20 people attended the session.

The workshop was divided into three sections. The first section, presented by Bov Eav, covered an overview of the principles of designing a survey. This section included an emphasis on statistical methods. Some examples were included. The second section covered the sketch map survey in the Pacific Northwest Region. This was a joint presentation by Tim McConnell and Kathy Sheehan. Tim talked about the logistics of a large scale insect survey. Kathy discussed the reporting process including the use of Geographic Information Systems (GIS). The last section, presented by Dick Myhre, concerned the use of aerial photography for insect surveys.

SECTION I: DESIGNING A SURVEY By B. Eav

Six points were presented for a pest impact survey.
1. Project planning: considerations, nature of the damage, planning team.
2. Sampling methods: simple random, systematic, cluster, and two-stage sampling.
3. Using ancillary information to better select the sampling units: stratified and variable probability sampling.
4. Using ancillary information to improve the estimate(s): regression and ratio estimates.
5. When ancillary information is not known for the entire population: double sampling for regression and two-stage double sampling for regression.
6. Choice of a sampling design.

Project planning was covered in great detail because it is an important first step. This included defining the purpose of the survey and the intended use of the results. The exact parameters to be estimated and the required precision of the estimates must be stated. Other considerations included identification of the total survey area, sub-areas, the role for remote sensing data, and all resources available for the survey. The distribution of the host, the recent history of the insect, and the damage measurements all affect how and when the survey should be carried out. The last item under project planning was the formation of a planning team.

The next points presented dealt with statistical sampling methods and the selection of a sampling scheme that will give estimates of the parameters of interest with the precision required. Examples were taken from past insect surveys to show the possible use for each method. The advantages and drawbacks of each approach were explained. The choice of sampling method was related back to the criteria present in project planning.

SECTION II. REGIONWIDE AERIAL SURVEYS By Tim McConnell and K. A. Sheehan

The regionwide survey of pest damage in the Pacific Northwest Region is based on aerial sketchmapping. Because there is so much mixed ownership on the forested lands, Washington and Oregon have agreed to do a cooperative annual survey with the Region. Two fixed-wing aircraft are used simultaneously, one in each state. Each year an annual safety meeting is held with all involved personnel. A coordination meeting of observers and pilots is held at this time also.

Most Regions do not have depth in their aerial survey cadre. It takes several seasons of aerial survey participation to become proficient. Base maps for sketchmapping are the Forest Series (1/2 inch:1 mile) and USGS (1:100,000) topography quad maps. It takes 60-80 hours to prepare maps for this survey.

During the survey two sketchmappers record information for a four mile wide strip, flown at 100 to 110 knots. At the end of a day's flight, they combine their maps into one master map. Ground checking is a vital part of aerial survey. Time pressure to get the survey completed has eliminated almost all ground checking except by district personnel. Hopefully this will change.

Mylar overlays of Forest maps are inked by tracing the master map. Digitizing for GIS is also done from the master map. In 1989 the Region inked 60 mylar maps and distributed these to Ranger Districts, BLM Districts, Indian Reservations, National Parks and the states of Washington and Oregon.

The Region used MOSS as their GIS. Digitized map files were imported into MOSS and base maps are produced that show insect damage, land ownership, wilderness areas, state forest districts, county and state boundaries. Maps can be drawn by MOSS at a range of scales on either paper or acetate. Tables can be produced using Paradox (a relational database) to summarize acres, number of trees, and volumes affected by pests. MOSS resides on the Data General and its use must be scheduled with other users on the system.

Aerial survey is a team effort requiring many specialized skills. Deadlines occur throughout the process. Training, documentation, and cooperation are the keys to success. New systems like GIS and Paradox add to the usefulness of the final product.

SECTION III. AERIAL PHOTOGRAPHY SURVEYS By Richard J. Myhre

Phase I - Mission Planning and Logistics. Photo mission planning is an important step toward: (1) meeting the overall objectives of an assessment or survey, and (2) acquiring photo coverage capable of providing the data needed through photo interpretation. The pest damage characteristics and the survey objectives will dictate the selection of various photographic elements, which must be evaluated and weighed against one another to determine the mission parameters. Mission elements include: type of photo coverage, photo scale, film type, overlap and sidelap, camera/film format, navigational aids, and timing of photo acquisition to coincide with the biological window of the pest.

If some of the mission elements are unknown or unproven, a feasibility test should be conducted as part of the designing/planning phase. Time and money can be saved by testing to determine the optimum elements to meet the specific survey objectives.

Phase II - Photo Interpretation Design and Planning. During the initial planning stages, serious consideration must be given to photo interpretation (P.I.) techniques and equipment. P.I. techniques cover such areas as photo sampling design, training of interpreters, P.I. methods, and P.I. aids and keys. A variety of P.I. equipment must also be considered, such as light tables, stereoscopes, measurement devices, and image/data transfer equipment/techniques.

WORKSHOP: PREDICTING PEST OUTBREAKS: HOW GOOD CAN WE GET?
Moderator: Alan A. Berryman

In preparing for this workshop I contacted around 100 people who I thought might have developed or used predictive models, or might help answer the question posed by the workshop. I received answers from 19 people and about 10 contributed reports or comments at the workshop.

The most commonly used predictive device still seems to be the trend index in which the numbers of insects or damage next year is predicted from the change from last year to this year. Exponential growth extrapolation, where the log-plot of insect numbers or damage is extrapolated into the future, can offer improved predictions at times. Modified exponential extrapolation, where the rate of growth is modified by various environmental parameters, can offer further improvements; e.g., the "Hog Model" for predicting southern pine beetle spot growth. A fourth refinement is the inclusion of a logistic term which enables prediction of population declines; e.g., POPSYS models.

Several other methods were presented, including phenology MPB models, overwintering "surge" indicators for SPB, pheromone trap thresholds, and various MPB rate of loss models. No evidence was presented that any of the large simulation models developed for DFTM, MPB, SPB, WSB, ESB, or GM have any value as predictive tools.

WORKSHOP: MANAGING INSECT PESTS IN SEED ORCHARDS
Moderator: Julie Weatherby
Participants: 20 participants

Moderator Julie Weatherby presented the results of a cone and seed insect survey which she distributed to tree improvement specialists and forest pest managers respresenting both state and federal agencies within the western states. No attempt was made to poll private industry. The USDA Forest Service has no plans to establish seed orchards in Regions 2 and 3. Seed orchards have been established in Regions 1, 5, and 6. Region 6 has more federal seed orchards than any other western region. The size of an average orchard ranged from 7 to 40 acres. In regions with established seed orchards 5% to 50% of the annual seed collection is expected to come from seed orchards by the year 2000. In Oregon, state seed orchards are expected to produce 95% of the annual seed collection by the year 2000.

Most people who responded to the survey felt that seed and cone infesting insects cause unacceptable losses at least in seed orchards and possibly in seed production and seed collection areas. Suppression tactics currently being used include sanitation, aerial and ground applications of chemical insecticides, systemic implants, pheromone disruption, granular encorporations, and topical chemical applications to graft unions. Many respondees felt that we need additional biological information on the major cone and seed insects, particularly the gall midge and various species of Dioryctria.

Orchard managers in state and federal seed orchards in Regions 1 and 6 use some insect monitoring techniques, and they expressed a real need for additional monitoring procedures. Most people who responded would consider using any suppression tactic which is cost-effective and environmentally appropriate particularly in seed orchards as opposed to seed production and seed collection areas.

Following the survey discussion, participants were encouraged to share their latest project results, concerns, or any other items applicable to the discussion. Discussion topics included:

1) Realistic rotations for a seed orchard may be 30 to 50 years rather than the more traditional longer rotation periods in forest stands.

2) In order to assess the impacts caused by cone and seed insects and to predict potential impacts, an orchard must have an accurate inventory of the current cone crop. Most orchards in the West do not routinely install a reliable cone monitoring/inventory system.

3) There has been a tremendous increase in the number of orchards being sprayed. In the early 1980's, only 4 or 5 orchards were being sprayed. Now it is becoming much more common.

4) Some orchards are not "clean picking" trees when adequate seed from that clonal source is in storage. This could lead to a build up of seed and cone pests. Solutions may include spraying even if trees are not picked, or treatment with compounds that will cause cone abscission.

5) Early spring aerial applications in coastal orchards are extremely difficult to accomplish because of adverse weather conditions.

6) Grasshopper control in newly planted orchards can be a real problem. There is some evidence that carbaryl bran bait is more effective than Nosema bran bait. A broadcast application of carbaryl works well as long as the entire planting is sprayed in addition to a 1- to 2-chain buffer around the perimeter of the planting. Additional suppression strategies might include netting and bantam chickens.

7) Roger Sandquist and Tom Koerber installed a study where they planned multiple implants for control of seed and cone insects. Presently, trees within the study have been implanted 4 times with no harmful affects.

8) New insecticide test data--Orthene implants applied to Scotch Pine in France controlled Pissodes; Spring implants gave good cone maggot control in larch and spruce; acephate implants in Douglas-fir reduce chalcid populations by 50%.

9) Capture^{R} is being registered in the Southeast for use in southern pine seed orchards. This chemical may be an alternative chemical for use in western seed orchards. Studies should be installed to determine the efficacy against western seed and cone pests.

10) The following comments and questions surfaced during a monitoring discussion:

   a. There is a need for an adult gall midge monitoring procedure in order to better time aerial insecticide applications.

   b. Adult gall midge emergence from the ground is not very reliable in terms of monitoring population size or timing aerial applications.

   c. Many orchard managers make casual observations and if they see even 1 seed bug then they spray.

   d. R5 is attempting to monitor coneworms at the Chico Tree Improvement Center by using pheromone baited traps. Trap catches of Dioryctria baumhoferi have been fairly common.

   e. Chris Niwa is developing a trapping system to monitor Megastigmus. The trapping procedures should be ready for field use by 1991. The monitoring system uses a passive trap. Populations considered damaging are expected when 1 or 2 males per trap are captured.

WORKSHOP: COORDINATION OF GYPSY MOTH MONITORING
Moderator: William Antrobius
Participants: Dawn Cameron, Ladd Livingston

Two case studies were examined involving intensified survey, and detection efforts, via pheromone trapping, as a result of gypsy moth introductions in Utah and Idaho.

Dawn Cameron, of the USDA Forest Service, State and Private Forestry, Forest Pest Management at Ogden, Utah opened the workshop with a presentation on the current state of affairs for Utah's gypsy moth survey, detection and eradication efforts. Utah is currently trying to eradicate established gypsy moth populations in the Salt Lake area using multiple applications of the bio-insecticide Bacillus thuringiensis. After it's initial detection by pheromone baited traps in 1988, eradication efforts aimed at the moth were begun in 1989. A total of 1200 acres were treated in 1989 using B.t. Purposed for 1990, are that approximately 20,064 acres be treated with multiple applications of B.t. in an attempt to eradicate the pest.

Based upon this sequence of events, it was stressed how important a well coordinated and thorough approach to detection monitoring was in locating introductions before they spread. Increased response time and lower costs associated with treatment programs were given as additional benefits. The implication was that the earlier an infestation can be found, the greater the chances that it can be successfully removed from the surrounding environment. Also discussed were the various agencies involved in Utah's cooperative treatment efforts, and those involved in survey and detection. The agencies involved in these cooperative efforts are: the Utah Department of Agriculture, the Animal, Plant and Health Inspection Service, the USDA Forest Service, the Olympic Cove Community Council, Salt Lake City Public Utilities, Utah Department of Lands and Forestry, the Wilderness Society, Salt Lake County Health Department, Utah State University Extension, and Salt Lake City Parks. Combined, the group is referred to as the "Gypsy Moth Decision and Action Committee". Roles and responsibilities of the various agencies and publics, which are organized into subcommittees, are determined by the Decision and Action committee.

Throughout the presentation three central themes were stressed: 1) a well coordinated and thorough monitoring program within the state is essential to detecting introductions before they can spread; 2) the time and effort spent on a thorough monitoring effort can result in increased reaction time, smaller treatment programs, and possible reductions in social/political conflicts associated with large treatment programs; and 3) good communications and planning among the interested agencies and publics is essential to successful treatment efforts.

Ladd Livingston of the Idaho Department of Lands, discussed the current monitoring and eradication efforts for gypsy moth in the State of Idaho. Currently, Idaho is trying to eradicate two separate infestations in Sandpoint and Coeur d'Alene. In 1990, approximately 1060 acres will be treated with multiple applications of B.t. followed by mass trapping.

Idaho has conducted a detection and trapping program since 1975. Trapping efforts were intensified in 1987 after a single moth catch occurred in Sandpoint in 1986. The following year (1987) multiple catches occurred in both Sandpoint and Couer d'Alene. The communities are located approximately 50 miles apart. In 1988, and total of 3,015 traps were placed throughout the state for detection purposes. Idaho increased it's trapping efforts significantly in 1989, with a total of 9549 trapping sites located throughout the state.

As was the case with Utah, Idaho considers early detection efforts to be paramount to successful treatment programs involving the gypsy moth. Cooperative efforts involving interested agencies and publics were indicated, not only in eradication attempts, but also in the survey and early detection phase of gypsy moth management. Discussed were the four State and Federal agencies involved in gypsy moth management in Idaho. The agencies were: the Idaho Department of Lands, Idaho Department of Agriculture, USDA Animal, Plant and Health Inspection Service and Region's 1 and 4 of the USDA Forest Service.

All participants pretty much agreed that the costs associated with intensified survey and detection efforts, via pheromone trapping, are preferable to those associated with large eradication or suppression projects which may result from a lack of these efforts.

Also discussed were the placement of detection trap sites on GIS data banks via their latitude and longitude coordinates. A western wide overview could be obtained (who's trapping what, where and when) and easily disseminated to state survey and detection committees now being formed throughout the western U.S.

WORKSHOP: NEW FOREST INSECTS
MODERATOR: Allen Robertson
PARTICIPANTS: Sandy Gast, Joe Fox, Jack Stein, John Dale

Eucalyptus Longhorned Borer - Allen Robertson
The eucalyptus longhorned borer (ELHB), Phoracantha semipunctata, a native of Australia, has recently been found in California. First reported in the south in 1984 it has now spread to 12 counties. Eucalyptus, of several species, are the most widely planted non-native tree in the state; used for ornamentals, windbreaks, cordwood, and pulp. To date, ELHB has been reported killing stressed trees and saplings in a number of areas in southern California. No tree killing in the north has occurred yet, however, the beetle has been reported breeding in slash and dead trees at three sites. Current efforts by CDF include detection and monitoring ELHB spread, public information and education about reducing tree stress, and supporting research on pheromones and parasites.

The Balsam Woolly Adelgid in Idaho - Sandy Gast
The balsam woolly adelgid is a European insect that feeds on true firs. It was introduced into North America about 1900 and quickly spread throughout the east and west from California to British Columbia. It was first discovered in Idaho in 1983. The adelgid is a tiny sucking insect that feeds by inserting its long mouthparts into the inner bark of its host trees. During feeding, it introduces a substance in the tree that causes abnormal growth of tree tissue. Infestations on limbs cause swelling or "gouting" of nodes and buds. Main bole infestations cause the cambium to produce wide irregular growth rings consisting of reddish brittle wood or "redwood". Heavy attacks on the stem can cause tree death. When the adelgid was first discovered in Idaho, it seemed to be confined to subalpine fir stands and has been abundant on grand fir. Native and imported parasites and predators have had minimal effect on balsam woolly adelgid populations. Other than species conversion, silvicultural control has not been very successful. Chemical insecticides are effective for high-value trees but are not feasible over large areas. There appears to be some host resistance but resistant trees are few. Cold winter temperatures may be a limiting factor. In Idaho, we have seen a large increase in adelgid populations and subsequent subalpine fir mortality which may be due to the past few years of abnormally long summers and mild winters. As the climate returns to normal, the population is expected to decrease.

Vectors of Pine Pitch Canker in California - Joe Fox
Pine pitch canker disease (caused by the pathogen, Fusarium subglutinans) appears to be a very recent introduction in California. The disease is found on pines along the central coast, particularly Monterey pine (Pinus radiata). The disease may be altering the abundance and distribution of

insects by weakening tree branches, which are colonized by insects. The pathogen was isolated from several species of insects in Santa Cruz Co. California which were captured in flight using pheromone traps or recovered from traps placed on pitch canker infected and healthy tree branches. Experimentally, we demonstrated the ability of Ips species (I. paraconfusus and I. mexicanus) to transmit the disease to uninfected pines. Ips species exhibited a fidelity of association with the disease through all life history stages both experimentally and naturally. Other insects such as Pityophthorus, Conophthorus, and an anobiid, Ernobius punctulatus, may be more important as primary carriers of the disease, while Ips may be a secondary vector, locally augmenting the incidence of the disease and colonizing weakened tree tops and branches.

Balsam Twig Aphid: A New Nursery Pest - Jack Stein

The balsam twig aphid (Mindarus abietinus) infests Abies and Picea species across the northern United States: population levels are often highest in young trees. Severe damage has been reported to Christmas tree plantations of grand fir (Abies grandis, white fir (A. concolor) and fraser fir. In 1987, the balsam twig aphid was first noticed in the USDA Forest Service Nursery at Placerville, California, in the central Sierra Nevada. Initial infestations were on 2-0 seedlings of white fir and bristlecone fir (A. bracteata). This is the first known report of balsam twig aphid infesting nursery stock, and the first time this species has been reported on bristlecone fir. The environment in the Placerville Nursery apparently has extended the life cycle of balsam twig aphid reported in the literature by at least 30 to 60 days. Also, the winged or alate stage apparently migrated into 2-0 white fir beds in May and into the 1-0 white fir beds in early August. In 1987, damage to 1-0 stock resulted in curled needles and an enlarged, club-like apex of current growth, in conjunction with the formation of an abnormal bud rosette. On 2-0 seedlings, this aphid feeds on elongating shoots causing discoloration and curling of new needles and distortion of terminal growth. Retarded bud formation and tip dieback could result in increased mortality or a delay in growth during the first year of outplanting.

Assorted Weevils at the Humboldt Nursery - John Dale

Four root weevils have been found at Humboldt Nursery, Pacific Southwest Region. The black vine weevil, Otiorhynchus sulcatus, and the vegetable weevil, Listioderes obliquus, have been recovered from seedling beds. The strawberry root weevil, O. ovatus, and the clover root curculio, Sitona hispidulus, have been recovered from fallow blocks. General life cycles were discussed, along with the habitat requirements of these weevils in relationship to the surroundings of the Humboldt Nursery. Ideas for monitoring schemes were solicited from those attending the workshop.

WORKSHOP: USE OF INSECTS IN VEGETATION MANAGEMENT
Moderator: George Ferrell

Topics that were discussed at this workshop include:

* the potential for biological control of shrubs
* native versus exotic biological control agents
* Pimentel's new association theory
* economic thresholds.

A need for an economic engineering approach, rather than the traditional target pest approach, was identified.

WORKSHOP: INSECT PHEROMONES FOR MONITORING
Moderator: Charles Sartwell
Participants: Jill Wilson, John Wenz, Julie Weatherby, Torgie Torgersen, Ralph Thier, Don Scott, Bernie Raimo, Dick Goyer, Ken Gibson, Jed Dewey, Steve Burke

What technology is now used?
Currently in western North America, pheromone-baited traps are used operationally to evaluate ambrosia beetle infestations in millyards, to predict outbreaks of Douglas-fir tussock moth, to detect and delimit gypsy moth infestations, and to certify that Christmas trees and nursery stock are not infested with European pine shoot moth. Also, trapping to predict defoliation by western spruce budworm was successfully tested on about 500,000 acres in 1988-89.

What new techniques might be available in the near future?
In the South, Ron Billings has lead development of a survey trapping system for southern pine beetle now widely used in 11 states. According to Dick Goyer, predictions based on number of beetles trapped and beetle/clerid ratio during spring are accurate more than 75% of the time in predicting trend of infestations. These predictions provide at least two months lead time in planning control activities. A similar survey scheme might be developed for one or more western bark beetles.

Charles Sartwell reported that Chris Niwa is testing use of passive traps to predict damage by Douglas-fir seed chalcid. Captures of females were in 1988 and 1989 were strongly related to subsequent seed damage. Male captures in 1988 were variable but good in 1989.

Sartwell also reported that much recent work at the Corvallis lab had focused on moths of the genus Dioryctria, with D. abietivorella the primary target and a very elusive one. However, effective attractants have been determined for D. pseudotsugella and, in cooperation with John Dale, D.baumhoferi, D. cambiicola, and D. ponderosae.

What are practical obstacles to wider use of traps for monitoring?
In some regions and for some pest problems, survey trapping is done primarily by entomologists. According to Bernie Raimo, this is the case with tussock moth and budworm trapping in Region 2, where few foresters have experience with defoliators. Commonly, however, foresters have responsibility for trap placement and retrieval, and they are also doing much counting of captured insects. John Wenz reported that Region 5 has a training package about tussock moth trapping. The package includes written materials and personal instruction, and a video may be added. Don Scott said that the increasing number of zone entomologists will lead to improved training of field foresters in pest management and increased local involvement in pest surveys.

Julie Weatherby observed that survey trapping for tussock moth and budworm works well when applied to large areas, and then asked whether trapping could be used to make site-specific predictions, such as in seed orchards.

Several people commented that more work needs to done toward determining how many traps or plots are needed for specified reliability.

What other insects need attention?
Most frequently mentioned were cone and seed insects, particularly seed bug, cone beetles, and midges.

WORKSHOP: THE APPLICATION OF GEOGRAPHIC INFORMATION SYSTEMS (GIS) IN FOREST PEST MANAGEMENT

Moderator: Ross Pywell

Panelists: Charles Dull, Bill Ciesla

The USDA Forest Service, Forest Pest Management (FPM) Staff, in Atlanta, Georgia has been utilizing remotely sensed information to map forest insect and disease conditions since 1956. Aerial photography and sketch map surveys provided data necessary to assess damage to forests as a result of forest insect and disease outbreaks. Geographic Information Systems (GIS) were implemented in 1977 to analyze, display, and store information collected from a wide variety of FPM activities. Recently forest health has arisen as a major and complex subject justifying nationwide attention by the USDA Forest Service due to the expressions of concern by the public and the continuing evidence of pests in the nation's forests. GIS and remote sensing technologies have been used by FPM to provide information needed to make resource management decisions.

The effects of forest pests and atmospheric deposition were reviewed to illustrate how GIS can be effectively utilized to understand the processes that affect forest health and the actions necessary to mitigate those effects. Forest pests are often symptoms of forest health problems.

Several projects have been undertaken by the FPM staff in Atlanta to utilize GIS to better understand the interactions of forest pests and other environmental influences on the health of the nation's forest. The following special projects were reviewed; 1) gypsy moth suppression and evaluation activities; 2) spruce-fir mortality evaluation in the southern Appalachians; 3) southern pine beetle demonstration project and its relationship to the development of the National Forest database in the Southeastern Region; and 4) implementation of the Southern Forest Atlas in support of the National Forest Health Monitoring Program.

The capability to perform spatial analysis and display data variables within and between various data bases, both spatial and relational, is essential for analyzing the relationships between tree growth and stress factors. GIS technology used to analyze remotely sensed data integrated with other data sources is used to meet the storage, analysis, display, and output capabilities necessary to support the implementation of programs to assess forest conditions. Results of the spatial analysis of relationships such as these will guide the development of sampling strategies and permit support of the implementation of surveying, monitoring, and control activities.

The USDA Forest Service, Forest Pest Management (FPM) Staff, in Portland, Oregon, has developed a GIS capability to support the Region's annual aerial detection survey. This capability uses the MOSS software which has been officially designated as the interim software for project level GIS applications in R-6. Base data layers which have been digitized include land ownership class, wilderness areas, key political boundaries and cultural features such as roads and towns. These layers have been digitized for all forested areas in Washington and Oregon using the 1:100000 scale USGS map series. Pest status information, by year, which

is acquired from aerial sketchmap surveys, is entered as an individual data theme. Three years of pest data are currently in the system. The MOSS software is used to generate statistical reports to meet Regional and National reporting requirements and map products.

The system has also been used to support planning of large insect suppression projects and to display the results of recent western spruce budworm suppression projects. We have succeeded in moving MOSS files from the FPM data base to ARC-INFO systems residing at the Washington Department of Natural Resources and the Bureau of Indian Affairs.

In addition to these ongoing projects, the Forest Pest Management, Methods Application Group in Fort Collins, CO is developing the Integrated Forest Resource Management System (INFORMS). The goal of INFORMS is to provide a vehicle for incorporating forest pest management concerns into the forest planning and management process. This will be accomplished through the development of a single system which integrates the many tools now being used by the resource manager (geographic information systems, database management systems, pest and resource models, and expert systems). These tools will be integrated into a single, user-friendly environment. An INFORMS prototype has been successfully applied on the Butte Ranger District of the Deerlodge National Forest. Further development efforts are underway on the La Grande Ranger District of the Wallowa-Whitman National Forest and the Neches Ranger District of the National Forests in Texas.

WORKSHOP: STATUS AND ROLE OF BIOTECHNOLOGY
Moderator: Shivanand Hiremath
Participants: Davy Jones, Shivanand Hiremmath and Syed Haider
Attendance: Approximately 25 people attended the workshop.

The workshop was divided into three parts to cover different aspects of the biotechnology research involving forest insect pests. One part dealt with the insect pests themselves, i. e., research towards understanding insect physiology and development, the knowledge gained from which can be utilized for developing insect control methods. Another part focused on the host trees. Efforts to modify genomes of forest trees by genetic engineering techniques to produce insect-resistant trees were discussed. The third part dealt with manipulation of the ecosystem as a means for forest insect pest management. Each part consisted of a presentation by one of the participants followed by a general discussion pertaining to the subject of the presentation.

In the first part Dr. Davy Jones of University of Kentucky discussed general aspects of application of molecular biological techniques to the research on insect physiology and development. He gave an overview of the advantages of using these powerful tools and how they can be utilized for the management of forest insect pests. He also discussed ongoing work in his laboratory where they are conducting research on i) juvenile hormone esterase from T. ni and ii) isolation of an enzyme that acylates non-toxic nornicotine in N. tabacum to make it toxic to insects. The title and abstract communicated to the moderator before the meeting was as follows:

Title: APPLICATIONS OF MOLECULAR BIOLOGY IN THE MANAGEMENT OF INSECT PESTS.
DAVY JONES, DEPARTMENT OF ENTOMOLOGY, UNIVERSITY OF KENTUCKY, LEXINGTON, KY

Abstract: The advances being made in Molecular Entomology present new possibilities in the future of insect pest management. Included in these possibilities are: new ways of delivery of insecticidal agents to insect pests (such as engineered insect microbes which carry genes for toxic proteins), new ways of making plants more resistant to insects (such as inserting genes which impart resistance in various ways), new vulnerable sites in target insects (such as a previously unknown pathway of gene expression leading towards metamorphosis), and putting lethal genes into populations of the target insects themselves. Examples of each of these strategies, and how they might be used against insect pests of forests and other commodities, will be discussed.

The subject of the second part was how genetic engineering tools can be used to manipulate the ecosystem to control the gypsy moth. Shivanand Hiremath (Shiv, for short) presented the work he and his collaborators have been conducting at NEFES, Delaware laboratory. The mission of this research is to generate high potency recombinant nuclear polyhedrosis virus(es) which will be more efficient than the natural strains to combat gypsy moth. Following is the title and summary of his presentation.

Title: BIOLOGICAL CONTROL OF GYPSY MOTH USING RECOMBINANT VIRUS.
SHIVANAND T. HIREMATH

Summary: Gypsy moth is the most important defoliating insect of hardwood trees in the Eastern United States. During the last decade the insect has

caused defoliation of at least one million acres each year. Consequent commercial timber losses are estimated to be about $67 million dollars per year. Nuclear polyhedrosis viruses specific for Gypsy moth (LdNPVs) have been demonstrated to combat the Gypsy moth outbreaks. However, these natural strains of LdNPVs are not effective due to their relatively low potency and the longer time they require in killing the insect. We are conducting research using genetic engineering techniques to generate novel, high potency strains of the virus by altering the viral genome.

Towards this end we have obtained a clonal isolate of the virus from Gypchek, determined its transcription and translation map. Transfer vectors which facilitate introduction of foreign genes into the virus have been constructed. These vectors contain about 1.5 kbp of promoter and upstream region of polyhedrin gene, a partially deleted polyhedrin structural sequences (lacking 211 bp from the N-terminus) and about 1.8 kbp sequences corresponding to downstream region. They differ only in the polylinker inserted just downstream from the promoter for insertion of foreign genes.

Foreign genes targeted for introducing into the virus include a) bacterial beta galactosidase, as a reporter gene; b) Bacillus thuringienses crystal toxin gene; c) genes of neurohormones such as prothoracicotrophic hormone; d) structural sequences coding for juvenile hormone esterase. Work on isolation and insertion of these genes into the virus are in progress. The recombinant virus will be evaluated under controlled conditions for its potency, efficacy, and safety.

The third talk was by Syed Haider of University of Washington, Seattle, who presented the work on efforts to develop insect-resistant poplar trees which is being conducted in Dr. Milton Gordon's laboratory. The title and abstract communicated by Syed Haider to the moderator are given below.

Title: TRANSFORMATION OF POTATO AND POPLAR WITH INSECTICIDAL BACILLUS THRUINGIENSIS (BT) GENES.
SYED T. HAIDER, MICHAEL A. HARKEY, DOUGLAS BRADLEY, CHARLES BROWN, HELEN WHITELEY AND MILTON GORDON

Abstract: We have constructed a set of plasmids that would enable us to add to the insecticidal Bacillus thuringiensis (BT) toxic protein gene sequences the necessary expression signals, while retaining the sequences required for insect toxicity. We have also cloned two BT genes cryIA(a) toxic to Lepidopterans (caterpillars) larvae and cryIIIA toxic to coleopterans (beetles) in binary Ti-plasmid vectors. The cryIA(a) construction has been tested by transforming tobacco and subjecting the transformed plants to insect bioassay using Manduca sexta larvae. Both of these BT genes have been transformed into potato. These genes should enable us to control Colorado potato beetle, potato tuber moth, cottonwood twig borers, poplar tentmakers and cottonwood leaf beetles. This work was supported by USDA and WTC grants.

After each presentation attendees participated in a general discussion. Most of the topics for discussion focused on safety and effectiveness of recombinant DNA technology.

WORKSHOP: ROLE OF PARASITES AND PREDATORS IN PEST MANAGEMENT
Moderator: Mitchel Miller
Participants: Andy Taylor, Alan Berryman, Torolf Torgersen

Andy Taylor described recently-begun research on the role of insect enemies in the initiation and collapse of southern pine beetle population outbreaks. His research takes two approaches: 1) long-term monitoring of total predation pressure, by exclusion cages, to determine the temporal dynamics of predation and its relation to SPB outbreaks, and 2) whole-tree cage experiments to describe the dynamics and density dependence of clerid predation and reproduction, as well as SPB reproduction.

Alan Berryman described his early research results in studies of the dynamics of western pine beetle based on predator abundance.

Mitch Miller discussed the effect on southern pine beetle natural enemies of host-tree antibiosis induced by infusion of N-methyldithiocarbamate + dimethyl sulfoxide. Results show a 10-fold reduction in SPB ratio of increase. Another investigators results show no detrimental impact on insect enemies and possible significant increase in Roptrocerus xylophagorum and Corticeus glaber.

Torolf Torgersen discussed the long-term effect of carbaryl treatment on western spruce budworm parasites. He observed that while percent parasitism was higher among carbaryl treated survivors, the actual number of parasites produced was reduced. More parasites were produced in years following carbaryl treatment in non-treated sites. He also discussed the benefits that might be derived from studies of ants and entomophagous birds on western spruce budworm and other defoliators. Predator-prey interactions are a stabilizing influence in the forest ecosystem. They serve to dampen oscillations in cycling pest populations. Conservation efforts, such as snag retention and recruitment, provide a resource for ants and cavity nesting birds are now being considered a valued tool in pest management of defoliators.

WORKSHOP: THE ROLE OF AI IN PEST MANAGEMENT
Moderator: Molly Stock
Participants: Barbara Bentz, Jesse Logan, Lukas Schaub, Bob Coulson

One outgrowth of the R&D programs of the 1970s and early 80s was the recognition that different types of information are needed by forest protection specialists for making decisions and solving problems. These include technical information, spatial data, historical files, simulation results, and professional experience. AI is helping us to integrate this information and deliver it in usable form to those who need it. We are seeing a shift away from stand-alone applications to increasing the practical efficiency of existing systems and adding machine intelligence to GIS, databases, and models. We are seeing greater portability and integration of systems, and greater sensitivity to user needs. These are some of the ideas discussed in this workshop.

DEVELOPMENT OF A MANAGEMENT INFORMATION SYSTEM FOR THE MOUNTAIN PINE BEETLE
Barbara J. Bentz

Unsuccessful efforts to eradicate mountain pine beetle populations have lead to investigations aimed at preventing population outbreaks. Toward this goal, recent research endeavors have identified conditions within the forest stand that are favorable to beetle population increase. U.S. Forest Service resource managers who can identify stands with these conditions would be able to minimize future pest problems caused by the beetle. Silvicultural treatments that alter the stand conditions could be prescribed, thereby making the environment less favorable for beetle population growth. The goal of this research is to incorporate strategies for mountain pine beetle management into the current decision process used by Forest Service resource managers. By incorporating both qualitative and quantitative information, this computerized system will help to bridge the gap between research and forest management.

THE GYPSES SYSTEM
Jesse Logan

In response to perceived needs for a more integrated and consistent approach to gypsy moth management, the Forest Service has funded an ambitious research program designed to apply advanced technologies to develop an integrated decision support system. This research/implementation project, GypsES (Gypsy moth Expert System), was initiated in 1989 and involves scientists from the Forest Service, Pennsylvania State University, Virginia Polytechnic Institute and State University, and the University of West Virginia. GypsES is a computer-based environment that will provide managers with an integrated set of decision-making tools. It will help managers deal with the complex problems of gypsy moth control, resource allocation, and program implementation with state-of-the-art technologies including database management systems, geographic information systems, knowledge-based systems, and statistical and simulation models. The knowledge-based components of the system include risk and hazard assessment, population monitoring, defoliation projection, phenological prediction, and intervention and evaluation. These knowledge bases are linked through an

intelligent GIS, an integrated database management system, a graphical user interface, and an intelligent communication manager.

GypsES development is being approached in five phases. The first phase included a series of meetings with potential end users to determine needs and approaches and feasibility of fulfilling those needs. Potential end users included Forest Service land managers and scientists, forest pest management specialists, and forest pest management administrators. The second phase was to assemble a team of system developers including entomologists, foresters, geographers, and computer scientists. This team prepared a design and implementation proposal that was funded by the USDA Forest Service Northeastern Forest Experiment Station. The third phase involves the development of a prototype system using a Macintosh II and Supercard, a Hypercard-like language. Potential end users and system designers will interact throughout prototype development. During this third phase, managers from national forests, national parks, counties, and cities will be involved with evaluating the prototype system. The fourth phase includes production of the functioning decision support system. The fifth phase will be field implementation and evaluation. GypsES is now in the fourth phase of development.

MONITORING DESIGNER COMPONENT OF GYPSES

L.P. Schaub, F.W. Ravelin, and J.A. Logan

The forest manager needs tools for assistance in planning and interpreting monitoring systems. We are building a system that designs sampling programs by interpreting data about gypsy moth, stand conditions, and management objectives. The system prioritizes management units within budget constraints and defines areas to be monitored. The system proposes monitoring procedures to guarantee an effective monitoring program. Interpretation of monitoring data predicts defoliation to be used in hazard ratings. Current and novel strategies are formalized through knowledge-based systems. The information is managed by geographic information systems and database management systems. Simulation and statistical models provide defoliation predictions. These technologies are integrated and made accessible for decision making by the forest manager.

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VICTORIA, BC CANADA
V8Z 1M5

GAST, SANDY (1990)
USDA FS NORTHERN REGION
COEUR D'ALENE, ID
83814

GEILS, BRIAN W. (1989)
ROCKY MT FOR & RANGE EXP ST
240 W. PROSPECT STREET
FORT COLLINS, CO
80526-2098

GIBBS, LORNA (1989)
PHERO TECH
1140 CLARK DRIVE
VANCOUVER, BC CANADA
V5L 3K3

GIBSON, KEN (1990)
USDA FS TCFPM
P.O. BOX 7669
MISSOULA, MT
59807

GILLESPIE, ANDREW J.R. (?)
USDA FOREST SERVICE
3825 E. MULBERRY
FORT COLLINS, CO
80524

GILLIGAN, CARMA (1990)
USDA FS TCFPM
P.O. BOX 7669
MISOULA, MT
59807

GIRARD, JEROME (1989)
PHERO TECH
1140 CLARK DRIVE
VANCOUVER, BC CANADA
V5L 3K3

GOYER, RICHARD A. (1990)
LOUISIANA STATE UNIV
DEPT OF ENTOMOLOGY
BATON ROUGE, LA
70803

GRACE, J KENNETH (1989)
FAC OF FORESTRY
U OF TORONTO
TORONTO, ONT CANADA
M5S 1A1

GRAY, TOM (1989)
PACIFIC FORESTRY CENTRE
506 W. BURNSIDE RD
VICTORIA, BC CANADA
V8Z 1M5

GREENE, LULA E. (1987)
PAC SW FOR & RANGE EXP ST
1960 ADDISON STREET
BERKELEY, CA
94701

GREGG, TOMMY F. (1989)
USFS PAC NW REGION
P.O. BOX 3623
PORTLAND, OR
97208

GREISE, GERHARD (1987)
SIMON FRASER UNIV
DEPARTMENT OF BIO SCI
BURNABY, BC CANADA
V5A 1S6

GRIMBLE, DAVID G. (1989)
FSL
3200 JEFFERSON WAY
CORVALLIS, OR
97331

HAACK, BOB (1988)
USDA FOREST SERVICE
1407 S. HARRISON RD RM. 220
E. LANSING, MI
48823

HADFIELD, JIM (1989)
USFS
P.O. BOX 3623
PORTLAND, OR
97208

HAIDER, SYED TANVEER (1990)
UNIVERSITY OF WASHINGTON
DEPT. OF BIOCHEM, SJ-70
SEATTLE, WA
98195

HAIN, FRED P. (1988)
NC STATE UNIV-DEPT OF ENT
BOX 7626 GRINNELLS LAB
RALEIGH, NC
27695

HALL, PETER M. (1990)
BC FOREST SERVICE
2nd FLOOR - BASTION SQUARE
VICTORIA, BC CANADA
V8W 3E7

HALL, RALPH C. (1988)
72 DAVIS RD
ORINDA, CA
94563

HAMEL, DENNIS (1989)
USFS WASHINGTON OFFICE
P.O. BOX 96090
WASHINGTON, D.C.
20013-6090

HANEMAN, DEIRDRE (1989)
USDA FOREST SERVICE
11177 W 8TH AVE
LAKEWOOD, CO
80225

HANSON, JIM (1989)
USDA FS
1922 FIKWEKK AVE
ST PAUL, MN
55108

HARD, JOHN S. (1990)
PACIFIC NW FOR & RANGE EXP ST
201 E. 9TH AVE.
ANCHORAGE, AK
99501

HARRELL, MARK O. (1987)
U OF NEBRASKA, DEPT OF FORESTRY
101 PLANT INDUSTRY
LINCOLN, NE
68583-0814

HARRIS, JERI LYN (1989)
DEPT FOR RESOURCES
UTAH STATE U
LOGAN UT
84322

HARRIS, JOHN W.E. (1989)
PACIFIC FORESTRY CENTRE
506 W BURNSIDE ROAD
VICTORIA, BC CANADA
V8Z 1M5

HART, DENNIS R. (1990)
USDA FS FPM
630 SANSOME ST ROOM 1037
SAN FRANCISCO, CA
94111

HARVEY, GEORGE T. (1989)
FORESTRY CANADA, ONTARIO REG. BOX 49
SAULT STE. MARIE, ONTARIO
CANADA
P6A 5M7

HASTINGS, FELTON L. (1990)
FORESTRY SCIENCES LAB
P.O. BOX 12254
RESEARCH TRI PARK, NC
27709

HAVERTY, MICHAEL I. (1990)
PACIFIC SW FOR & RANGE EXP ST
P. O. BOX 245
BERKELEY, CA
94701

HEASLEY, JOHN E. (1990)
RESOURCE ANALYSIS SYSTEMS
333 WEST DRAKE ROAD, SUITE 240
FORT COLLINS, CO
80526

HEATH, DICK (1987)
MIS OF FOR
540 BORLAND STREET
WILLIAMS LAKE,BC CANADA
V2G 1R8

HEIDMANN, LEROY J. (1988)
29 WEST SILVER SPRUCE
FLAGSTAFF, AZ
86001

HERMS, DAN (1989)
DEPT ENTOMOLOGY
MICHIGAN STATE UNIVERSITY
E. LANSING, MICH
48640

HIREMATH, SHIVANAND (1990)
USDA FOREST SERVICE
359 MAIN ROAD
DELAWARE, OH
43015

HITT, SAM (1988)
ECOLOGICAL PEST MANAGEMENT
80 E. SAN FRANCISCO
SANTA FE, NM
87501

HOBSON, KEN (1988)
DEPARTMENT OF ENTOMOLOGY
UC BERKELEY
BERKELEY, CA
94720

HOFACKER, THOMAS H (1989)
USFS WASHINGTON OFFICE
P.O. BOX 96090
WASHINGTON D.C.
20013-6090

HOLLAND, DAVID G. (1989)
USDA FS INTERMOUNTAIN REGION
324 25TH STREET
OGDEN, UT
84401

HOLMES, MATT (1987)
BEND RESEARCH, INC.
64550 RESEARCH ROAD
BEND, OR
97701

HOLMS, KEITH (1989)
ROHNE-POULENC
2491 W SHORE DR STE. 123
FRESNO, CA
93711

HOLSTEIN, ED (1989)
USDA FS FPM
201 EAST 9TH SUITE 201
ANCHORAGE, AK
99501

HOLT, JOAN (1989)
BOX 922
KAMLOOPS, BC
CANADA
V2C 5N4

HOMAN, HUGH W. (1987)
U OF I
DEPT OF ENTOMOLOGY
MOSCOW, ID
83843

HONEA, RONALD C. (1988)
MISS ST UNIV-DEPT OF ENT
P.O. BOX DRAWER EM
MISSISSIPPI STATE, MS
39762

HOSMAN, KEVIN (1989)
USDA FS PNW
1401 GEKELER LANE
LA GRANDE, OR
97850

HOSTETLER, BRUCE B (1988)
USDA FOREST SERVICE, FPM
P.O. BOX 3623
PORTLAND, OR
97208

HOWARD, BENTON (1989)
4129 SE STARK
PORTLAND, OR
97214

HRYNYSHYN, DONNA F. (1987)
U OF WY-PLANT SCI DEPT
BOX 3354
LARAMIE, WY
82071

HUEBNER, DAN (1989)
1109 S. PLAZA WAY
280
FLAGSTAFF, AZ
86001

HUGHES, JOHN M. (1987)
USFS NORTHERN REGION
P.O BOX 7669
MISSOULA, MT
59807

HUMBLE, L.M. (1990)
FORESTRY CANADA
506 W BURNSIDE ROAD
VICTORIA, BC CANADA
V8N 1Z5

HUNT, RICHARD (1989)
CALIFORNIA DEPT. OF FORESTRY
1416 9TH STREET
SACRAMENTO, CA
95814

IDAHO DEPARTMENT OF LA (?)
C/O LARRY FRYBERG
P.O. BOX 909
SANDPOINT, ID
83864

IRWIN, EUGENE A. (1989)
OREGON ST DEPT OF FORESTRY
2600 STATE STREET
SALEM, OR
97310

JENKINS, MICHAEL J. (1987)
UTAH ST UNIVERSITY
DEPARTMENT OF FOREST RESOURCES
LOGAN, UT
84322-5215

JENNINGS, DAN (1989)
USDA FS FLS
P.O. BOX 4360
MORGANTOWN, WV
26505

JENSON, GARY (1989)
PACIFIC FORESTRY CENTRE
506 W BURNSIDE ROAD
VICTORIA, BC CANADA
V8Z 1M5

JOHNSEY, RICK L. (1990)
WASHINGTON ST DEPT OF NAT RES.
MAIL STOP MQ - 11
OLYMPIA, WA
98504

JOSEPH, GLADWIN (1989)
OREGON ST UNIV
DEPT OF ENTOMOLOGY
CORVALLIS, OR
97331

KALE, P.B. (1987)
UNIVERSITY OF IDAHO
DEPT OF FOREST RESOURCES
MOSCOW, ID
83843

KALVE, VALERIE (1990)
USDA FS FPM
507 25TH STREET
OGDEN, UT
84401

KEARSLEY, MIKE (1988)
N AZ UNIV-DEPT OF BIO SCI
BOX 5640
FLAGSTAFF, AZ
86011

KEMP, WILLIAM P. (1987)
MSU-USDA-ARS
RANGELAND INSECT LAB
BOZEMAN, MT
59717

KINN, DONALD N. (1990)
USDA FOREST SERVICE
2500 SHREVEPORT HWY.
PINEVILLE, LA
71360

KINZER, H.G. (1987)
NM STATE UNIV
BOTANY & ENTOMOLGY DEPT
LAS CRUCES, NM
88003

KLINE, LEROY N. (1989)
OREGON ST DEPT OF FORESTRY
2600 STATE ST
SALEM, OR
97310

KNAPP, ANDY (1989)
USDA FOREST SERVICE FPM
1750 FRONT ST
BOISE, ID
83702

KNAUER, KEN (1990)
USDA FOREST SERVICE
P.O. BOX 96090
WASHINGTON, D.C.
20013-6090

KNOWLES, KEITH (?)
MANITOBA NATURAL RES.
300-530 KENASTON BLVD.
WINNIPEG, MANITOBA CANADA
R3N 1Z4

KOERBER, THOMAS (1990)
ENTOMOLOGICAL SERVICE COMPANY
P.O. BOX 992
BERKELEY, CA
94701

KOHLER, STEVE (1989)
MONTANA DIV OF FORESTRY
2705 SPURGIN ROAD
MISSOULA, MT
59801

KORELUS, VLAD J. (1987)
CIP, INC, TAHSIS PAC REGION
8067 E. SAANICH ROAD, RR # 1
SAANICHTON, BC CANADA
VOS 1MO

KORN, MICHAEL J. (1989)
USDA FS
P.O. BOX 38
UNITY, OR
97884

KRANNITZ, STAN (1987)
PHERO TEC
1140 CLARK DRIVE
VANCOUVER, BC CANADA
V4A 4G9

KRASKE, JOHN (1988)
AZ STATE LAND DEPT
3650 LAKE MARY RD
FLAGSTAFF, AZ
86001

KREBILL, DICK (1990)
USDA FOREST SERVICE, INT
324 25TH STREET
OGDEN, UT
84403

KULMAN, HERBERT M. (1989)
UNIV OF MINNESOTA
DEPT OF ENTOMOLOGY
SAINT PAUL, MN
55108

KUMI, JANNA (1987)
MACMILLAN BLOEDEL LTD.
65 FRONT STREET
NANIMO, BC CANADA
V9R 5H9

KUNIS, DAN (1988)
8060 NIWOT RD. , # 30
LONGMONT, CO
80501

LAMADELEINE, LEON (1989)
USDA FS FPM
507 25TH ST
OGDEN, UT
84401

LANGOR, DAVID (1987)
NORTHERN FORESTRY CENTRE
5320 122ND STREET
EDMONTON, ALBERTA CANADA
T6G 3S5

LAUT, JOHN (1988)
COLORADO STATE FOREST SERVICE
FORESTRY BLDG, CSU
FORT COLLINS, CO
80523

LAVIGNE, ROBERT (1990)
DEPT OF PLANT, SOIL, ENT
BOX 3354 UNIVERSITY OF WYOMING
LARAMIE, WY
82071

LEATHERMAN, DAVID A. (1989)
COLORADO STATE FOREST SERVICE
COLORADO ST UNIV
FORT COLLINS, CO
80523

LESSARD, GENE (1989)
USDA FS FPM ALASKA REGION
201 E. 9TH AVE
ANCHORAGE, AK
99501

LEWIS, VERNARD (1989)
DEPT ENTOMOLOGY
UC BERKELEY
BERKELEY, CA
94720

LIEBHOLD, ANDREW (?)
USDA FOREST SERVICE
P.O. BOX 4360
MORGANTOWN, WV
26505

LIEBHOLD, SANDY (1988)
USDA FOREST SERVICE
P.O. BOX 4360
MORGANTOWN, WV
26505

LIEBL, JOSEPH R. (1990)
USDA FOREST SERVICE
P.O. BOX 759
WINTHROP, WA
98862

LIH, MARITA P. (1987)
UNIV OF ARKANSAS, DEPT OF ENT
AGRICULTURE BLDG, ROOM 320
FAYETTEVILLE, AR
72701

LIN, YIQUN (1988)
N AZ UNIV SCHOOL OF FORESTRY
BOX 4098
FLAGSTAFF, AZ
86011

LINDGREN, STAFFAN (1990)
PHERO TECH INC.
7572 PROGRESS WAY RR#5
DELTA, BRITISH COLUMBIA
V4G 1E9

LINIT, MARC (1990)
ENTOMOLOGY DEPARTMENT
UNIVERSITY OF MISSOURI
COLUMBIA, MO
65211

LINN, JOE (?)
DORENA TREE IMPROVEMENT CENTER
PO BOX 7
COTTAGE GROVE, OR
97424

LINNANE, JIM (1988)
517 GOLD AVE., SW
ALBUQUERQUE, NM
87102

LISTER, KEN (1990)
USFS ROCKY MT REGION
P.O. BOX 25127
LAKEWOOD, CO
80225

LIVINGSTON, R. LADD (1990)
IDAHO DEPT OF LANDS
P.O. BOX 670
COEUR D'ALENE, ID
83814

LOGAN, JESSE A. (1990)
VIRGINIA POLYTECHNIC & ST UNIV
DEPARTMENT OF FORESTRY
BLACKSBURG, VA
24061-0324

LOGAN, ROBERT (1987)
SCHOOL OF FORESTRY
UNIVERSITY OF MONTANA
MISSOULA, MT
59812

LONG, DAVID (1988)
N ARIZONA UNIV
BOX 4098
FLAGSTAFF, AZ
86011

LONG, GARRELL E. (1990)
WASHINGTON STATE UNIV
DEPT OF ENTOMOLGY
PULLMAN, WA
99164-6432

LOOD, RUDIE (?)
P.O. BOX 343
HAYDEN LAKE, ID
83835

LORIO, PETER L., JR (1990)
USDA FS SFES 2500 SHREVEPORT HWY.
P.O. BOX 5500
PINEVILLE, LA
71360

LOVE, BILL (1989)
IDAHO DEPT OF LANDS
P.O. BOX 670
COEUR D'ALENE, ID
83814

LOVELADY, CLARK (1990)
DEPARTMENT OF ENTOMOLOGY
TEXAS A & M UNIVERSITY
COLLEGE STATION, TX
77843

LUCK, ROBERT F. (1987)
UNIV OF CA DIV OF BIO CONTROL
DEPT OF ENTOMOLGY
RIVERSIDE, CA
92521

LYNCH, ANN N. (1989)
ROCKY MT FOR & RANGE EXP ST
240 W PROSPECT ST
FORT COLLINS, CO
80526-2098

LYON, ROBERT L. (1987)
USFS WASHINGTON OFFICE
P.O. BOX 96090
WASHINGTON, D.C.
20013-6090

MACLAUCHLAN, LORRAINE (1989)
c/o MINISTRY OF FORESTS
515 COLUMBIA STREET
KAMLOOPS, BC CANADA
V2C 2T7

MAHER, THOMAS (1989)
TFM FORESTRY LTD
P.O. BOX 364
KAMLOOPS, BC CANADA
V2C 5K9

MANGOLD, ROB (1989)
USFS
COTTAGE GROVE R.D.
COTTAGE GROVE, OR
97424

MANTHEI, MICHAEL E. (1988)
COCONINO F=NF
2323 E. GREENLAW LANE
FLAGSTAFF, AZ
86001

MARKIN, GEORGE P. (1989)
PAC SW FOR & RANGE EXP ST
1151 PUNCHBOWL ST, ROOM 323
HONULULU, HI
96813

MARSDEN, MICHAEL A. (1990)
USDA FS ROCKY MTN STATION
240 W PROSPECT
FORT COLLINS, CO
80526-2098

MASON, GARLAND N. (1988)
USDA FS PSW
P.O. BOX 245
BERKELY, CA
94701

MASON, RICHARD R. (1989)
USDA FS PNW
1401 GEKELER LANE
LAGRAND, OR
97850

MATA, S.A. (1989)
RM STN
240 W. PROSPECT
FT COLLINS, CO
80526

MATHIASEN, ROBERT (1989)
N ARIZONA UNIV
BOX 4098
FLAGSTAFF, AZ
86011

MATTSON, CARL J. (1989)
KETTLE FALLS RD
COLVILLE NF
KETTLE FALLS, WA
99141

MAULDIN, JOE (1989)
SOUTHERN EXP STN
P.O. BOX 2008
GULFPORT, MS
39505

MAY, TAMMY (1989)
USDA FOREST SERVICE FSL
3200 JEFFERSON WAY
CORVALLIS, OR
97331

MC COMB, DAVID (RED) (1990)
P.O. BOX 163
WINTHROP, WA
98862

MC CONNELL, TIM (1990)
USDA FS P.O. BOX 3623
319 SW PINE
PORTLAND, OR
97208

MC CULLOUGH, DEBBIE (1989)
UNIV OF MINN. DEPT OF ENT
HODSON HALL
ST. PAUL, MN
55108

MC GREGOR, MARK (1990)
1916 - 35TH ST
MISSOULA, MT
59801

MC KNIGHT, MEL (?)
426 PEEKSKILL LANE
FAIRFAX, VA
22033

MC WILLIAMS, MIKE (1989)
FSL
3200 JEFFERSON WAY
CORVALLIS, OR
97331

MCLEAN, JOHN A. (1990)
DEPT. OF FOREST SCIENCES, U.B.C.
270-2357 MAIN HALL
VANCOUVER, B.C.
V6T 1W5

MENEELY, SCOTT C. (1988)
US BUREAU OF INDIAN AFFAIRS
BRANCH OF FORESTRY, BOX 209
SAN CARLOS, AZ
85550

MERICKEL, FRANK W. (?)
PLANT, SOIL AND ENT. SCIENCES
UNIVERSITY OF IDAHO
MOSCOW, ID
83843

MEXAL, JOHN (1988)
NEW MEXICO STATE UNIV
DEPT OF AGRONOMY & HORTICULTURE
LAS CRUCES, NM
88003

MEYER, HUBERT (1990)
2532 HIGHWOOD DR.
MISSOULA, MT
59803

MILLER, DAN (1988)
SIMON FRASER U-DEPT OF BIO SCI
BURNABY, B.C.
CANADA
V5A 1S6

MILLER, GORDON (1987)
PACIFIC FORESTRY CENTRE
506 W BURNSIDE ROAD
VICTORIA, BC CANADA
V8Z 1M5

MILLER, JEFFERY C. (1989)
DEPT. OF ENTOMOLOGY
OREGON STATE UNIV.
CORVALLIS, OR
97331

MILLER, MITCHEL C. (1990)
SOUTHERN FOREST EXPERIMENT STN
2500 SHREVEPORT HWY
PINEVILLE, LA
71360

MITCHELL, JAMES C. (1988)
BOX 900
RT. # 4
FLAGSTAFF, AZ
86001

MITCHELL, RUSS (1990)
USDA FS SILVICULTURE LAB
1027 NW TRENTON AVE.
BEND, OR
97701

MITTON, JEFF (1987)
UNIV OF COLORADO
DEPT OF EPO BIOLOGY
BOULDER, CO
80309

MOCETTINI, PHIL (1990)
USDA FOREST SERVICE
1750 FRONT ST. RM 202
BOISE, ID
83702

MOECK, HENRY A. (1987)
PACIFIC FORESTRY CENTRE
506 W BURNSIDE RD
VICTORIA, BC CANADA
V8Z 1M5

MOODY, BEN (1989)
CANADIAN FORESTRY SERVICE
351 ST JOSEPH BLVD
HULL, QUEBEC, CANADA
K1A 1G5

MOORE, MARGARET M. (1988)
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FLAGSTAFF, AZ
86011

MORSE, BRUCE W. (1987)
UNIV OF MN-DEPT OF ENT
HODSEN HALL
ST PAUL, MN
55108

MOSER, JOHN C. (1989)
S FOREST EXPERIMENT STN.
2500 SHREVEPORT HWY
PINEVILLE, LA
71360

MUDGE, ALAN (1990)
OREGON DEPARTMENT OF AGRICULTURE
635 CAPITOL STREET NE
SALEM OR
97310-0110

MUNSON, STEVE (1989)
USDA FS FPM
324 25TH ST
OGDEN, UT
84401

MYHRE, RICHARD J. (1990)
USFS FPM/MAG
3825 E MULBERRY
FT COLLINS, CO
80524

NASH, BRUCE (1987)
PENN ST UNIV
DEPT OF PLANT PATHOLOGY
UNIVERSITY PARK, PA
16802

NE, ZHONG (1988)
OREGON ST UNIV
ENTOMOLOGY DEPT.
CORVALLIS, OR
97331

NEBEKER, T. EVAN (1990)
MSU DEPT OF ENTOMOLOGY
P.O. DRAWER EM
MISSISSIPPI STATE, MS
39762

NEFF, DAVID (1989)
CDF & FD
2524 MULBERRY ST
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92502

NEISESS, JOHN (1989)
USFS PAC SW REGION
630 SANSOME STREET
SAN FRANCISCO, CA
94111

NELSON, BRYAN (1989)
STATE FORESTRY
2600 STATE ST.
SALEM, OR
97310

NIELSON, DAVID G. (1989)
DEPT OF ENTOMOLOGY
OSU-OARDC
WOOSTER, OH
44691

NIWA, CHRISTINE G. (1989)
PAC NW FOR & RANGE EXP ST
3200 JEFFERSON WAY
CORVALLIS, OR
97331

OHMART, CLIFFORD P. (1987)
CSIRO, DIV OF FOR RES
BOX 4008, QUEEN VICTORIA TERRAC
CANBERRA, A.C.T. 2600
AUSTRALIA

ONKEN, BRAD (1989)
USDA FOREST SERVICE
180 CANFIELD ST
MORGANTOWN, WV
26505

ONO, HIDEJI (?)
ALBERTA FORESTRY
P.O. BOX 7040 PO. STA. M
EDMONTON, ALBERTA CANADA
T5E 5S9

ORR, DAVID (1989)
ALASKA DIVISION OF FORESTRY
P.O. BOX 10-7005
ANCHORAGE, AK
99501

OSTROWSKI, RICHARD C. (1987)
UNITED AG PRODUCTS
P.O. BOX 1286
GREELEY, CO
80632

OTVOS, IMRE S. (1987)
PACIFIC FORESTRY CENTRE
506 W BURNSIDE RD
VICTORIA, BC CANADA
V8Z 1M5

OVERHULSER, DAVID L. (1989)
OR STATE DEPT OF FORESTRY
2600 STATE ST
SALEM, OR
97310

OWEN, DONALD R. (1989)
CA DEPT OF FORESTRY
6105 AIRPORT RD
REDDING CA
96002

PAGE, MARION (1990)
PAC SW FOR & RANGE EXP ST
1960 ADDISON ST
BERKELEY, CA
94701

PAINE, TIMOTHY D. (1990)
UNIV OF CALIFORNIA
DEPT OF ENTOMOLOGY
RIVERSIDE, CA
92521

PANDILA, MADAN (?)
SASKATCHEWAN PARKS, RES.& CUL.
P.O. BOX 3003
PRINCE ALBERT, SASKATCHEWAN
S6V 6G1

PARKER, DOUGLAS (1989)
USDA FOREST SERVICE
517 GOLD AVE. SW
ALBUQUERQUE, NM
87102

PASEK, JUDITH E. (1990)
USDA FOREST SERVICE
501 E. St. JOE, SDSMT
RAPID CITY, SD
57701

PAYNE, THOMAS L. (1990)
DEPARTMENT OF ENTOMOLOGY
VIRGINIA TECH.
BLACKSBURG, VA
24061

PEAVY, ANDREW T. (1988)
P.O. BOX 0
SAN CARLOS, AZ
85550

PETERSON, GARY J. (1990)
USDA FOREST SERVICE
SISTERS R.D. P.O. BOX 249
SISTERS, OR
97759

PETTINGER, LEON (?)
16252 BLUFF ROAD
SANDY, OR
97055

PHILLIPS, GREGORY C. (1988)
NM STATE UNIV-DEPT OF AG. & HORT.
PLANT GENETIC ENG LAB
LAS CRUCES, NM
88003-0003

PHILLIPS, RICHARD (1988)
NM STATE UNIV-DEPT OF AG. & HORT.
LAS CRUCES, NM
88003

PHILLIPS, THOMAS W. (1987)
DEPT OF ENT-UNIV OF FLORIDA
3103 MCCARTY HALL
GAINESVILLE, FL
32611

PRICE, PETER W. (1988)
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86011

PYWELL, H. ROSS (1990)
USDA FOREST SERVICE
3825 E. MULBERRY
FORT COLLINS, CO
80524

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PORTLAND, OR
97208

RAIMO, BERNIE (1990)
USDA FS FPM
216 N COLORADO
GUNNISON, CO
81230

RANDALL, WILLIAM (1988)
USDA FOREST SERVICE
P.O. BOX 1148
CORVALLIS, OR
97339

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PAC SW FOR & RANGE EXP ST
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83702

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18114 BOLLINGER CYN RD
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94583

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1960 ADDISON ST
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94704

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3502 HWY 30
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94111

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97310

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97850

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FINNISH FOR. RES. INST.
UNIONINKATU 40A
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UNIV OF BC-FACULTY OF FORESTRY
2357 MAIN HALL
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V6T 1W5

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SAULT STE MARIE, ONT
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P6A 5M7

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83843

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ROCKY MT FOR & RANGE EXP ST
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80526-2098

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2004 FOLWELL AVE
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55108

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USDA FOREST SERVICE
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59715

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84401

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COLORADO STATE FOREST SERVICE
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80523

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OR STATE UNIV
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97331

SCHULTZ, DAVE (1990)
USDA FOREST SERVICE
2400 WASHINGTON AVE.
REDDING, CA
96001

SCHWALBE, CHARLES P. (1987)
USDA-PPQ
GYPSY MOTH LAB
OTIS AFB, MA
02542

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1401 GEKELER LANE
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97850

SEYBOLD, STEPHEN J. (1989)
UC-BERKELEY
218 WELLMAN HAL
BERKELY, CA
94720

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98195

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SCENTRY, INC
P.O. BOX 426
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85326

SHAW, TERRI (1989)
400 RIDGEWOOD CT.
SHAW, TERRI
FT. COLLINS, CO
80524

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94701

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97208

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885 EASTLAKE BOULEVARD
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89704

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USDA FOREST SERVICE
2121 C 2ND STREET
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95616

SLOAN, TERRY (1988)
AZ STATE LAND DEPT-PRESCOTT DIST
899-C GAIL GARDNER WAY
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86301

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10196 RED SPRUCE RD
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22032-3607

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USDA FS
FSL, CARLTON ST
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30602

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T6G 2E3

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US FOREST SERVICE - INT
1221 S. MAIN ST
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83843

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520 S. FIRST
SANDPOINT, ID
83864

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94533

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451 NW HAMLOCK AVE
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97330

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72701

STIPE, LARRY (1990)
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P.O. BOX 7669
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STOCK, ARTHUR J. (1989)
SIMON FRASER U-DEPT OF ENT
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V5A 156

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83843

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83843

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97128

SU, NAN-YAO (1989)
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33314

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270-2357 MAIN MALL
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13210

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1750 FRONT STREET
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71360

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59807

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71655

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83814

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2323 E. GREENLAW LN
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86004

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1401 GEKELER LANE
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97368

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P.O. BOX 3623
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97208-3623

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14850

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82729

TREASURER'S REPORT, WFIWC
PRELIMINARY BUSINESS MEETING
6 MARCH 1990

April 1987	Started with a deposit:		1453.00
	Expenses:	5.99	
	Deposits:	42.86	1489.87
29 Feb 88	Received from Park City 1987 Meeting	3528.29	5018.16
	Expenses:	0.0	
	Deposits:	115.84	5134.00
29 Aug 89	Received from Flagstaff 1988 Meeting	1400.00	6534.00
	Deposited $5000 in timed deposit check book balance		1534.00
	Expenses:	866.33	
	Deposits:	480.50	1148.17
2 Jan 90	Received from Bend 1989 Meeting	3413.84	4562.01
Balance on hand prior to the 1990 meeting		checking:	4562.01
		timed deposit:	5083.39
	Expenses:	3588.49	
	Deposits:	5733.76 ckng.	6707.28
		timed deposit:	5137.22
	TOTAL ON HAND AS OF 6 MARCH 1990		11,844.50

CONSTITUTION
OF THE
WESTERN FOREST INSECT WORK CONFERENCE

Article I Name

The name of this organization shall be the Western Forest Insect Work Conference.

Article II Objects

The objects of this organization are (1) to advance the science and practice of forest entomology, (2) to provide a medium of exchange of professional thought, and (3) to serve as a clearing house for technical information on forest insect problems of the western United States and Canada.

Article III Membership

Membership in this organization shall consist of forest entomologists and others interested in the field of professional forest entomology. Official members shall be those who pay registration fees.

Article IV Officers and Duties

The Officers of this organization shall be:

(1) A Chairman to act for a period of two meetings, whose duties shall be to call and preside at meetings and to provide leadership in carrying out other functions of this organization.

(2) An Immediate Past Chairman, who shall assume office immediately upon retiring as Chairman without further election; whose duties shall be to fill the chair at any meeting in the absence of the Chairman; to act until the election of a new Chairman.

(3) A Secretary to act for a period of two meetings whose duties shall be to keep a record of Executive Actions, record minutes of Executive Committee and conference business meetings, to maintain committee correspondence, and to send out notices, reports, and proceedings. The Secretary is charged with the responsibilities of coordinating preparation of the proceedings (amended Feb. 28, 1967, Las Vegas, NV and Sept. 15, 1989, Bend, OR).

(4) A Treasurer, who is a non-voting member of the Executive Committee, to act for an indefinite term, whose duties shall be to keep a record of funds collected and disbursed, to issue monies for approved purposes, to maintain a record of members, committees, and officers, and to provide mailing lists and/or labels as needed. The Treasurer will provide financial records for inspections by a two-member Executive audit team, comprised of the Chairman and Immediate Past Chairman annually prior to the Executive Committee meeting (amended Sept. 15, 1989, Bend, OR).

(5) An Executive Committee of six members consisting of Chairman, Immediate Past Chairman, Secretary, Treasurer, and three Counsellors eleced from the membership. Terms of office for the three Counsellors shall be staggered and for a period of three meetings each. The duties of the Committee shall be to carry out actions authorized by the Conference; to authorize expenditures of funds, and to establish policies and prodedures for the purpose of carrying out the functions of the organization. The Conference registration fee will be set by the Local Arrangements Committee in consultation with the Secretary, Treasurer, and Chairman (amended March 4, 1965, Denver, CO and Sept. 15, 1989, Bend, OR).

The officers shall be elected at the Annual Meeting. Their periods of office shall begin at the conclusion of the meeting of their election.

The Chairman shall have the power to appoint members to fill vacancies on the Executive Committee occurring between meetings. The appointment to stand until the conclusion of the next general meeting.

It is the responsibility of a Counsellor, should he be unable to attend an executive meeting, to appoint an alternate to attend the executive meeting and to advise the Chairman in writing accordingly. The alternate shall have full voting privileges at the meeting to which he is designated.

Article V Meetings

The objectives of this organization may be reached by holding at least an annual conference and such other meetings as the Chairman, with the consent of the Executive Committee, may call. The place and date of the annual meeting shall be determined by the Executive Committee after considering any action or recommendation of the conference as a whole. The Secretary shall advise members of the date and place of meetings at least three months in advance.

Article VI Proceedings

A record of proceedings of the conference shall be maintained and copies provided to members in such form as may be decided as appropriate and feasible by the Executive Committee.

Article VII Amendments

Amendments to the Constitution may be made by a two-thirds vote of the total conference membership attending any annual meeting.

Prepared by Richard Washburn
March 20, 1969

APPENDIX

Title: North American Forest Insect Work Conference

Theme: Getting ready for the 21st century

Objective: Organize and conduct workshops to discuss forest entomology education, research, and pest management needs in the next decade as perceived by leading forest managers, researchers and educators. Emphasize changing technology, future needs of resource management and the interdisciplinary nature of forest health issues.

Product: A workshop proceedings that includes keynote papers, workshop discussion summaries and recommendations.

Audience: Forest Entomologists and Pathologists

Site: Denver, Colorado - Raddison Hotel

Date: March 25-28, 1991

Agenda:

Monday, March 25
PM - Welcome and Keynote speakers
evening - Mixer

Tuesday, March 26
AM - Finish Keynote speakers
AM - Start series of workshops (2-4 hours in length)
PM - Workshops

Wednesday, March 27
all day - Workshops

Thursday, March 28
AM - Workshops

Note: a poster session will be held one evening, and time for business meetings of individual work conferences will also be scheduled